JOURNAL

OF

THE FRANKLIN INSTITUTE,

OF THE

State of Pennsylvania,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE, CIVIL ENGINEERING, THE ARTS AND MANUFACTURES, AND THE RECORDING OF AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED BY
JOHN F. FRAZER,
Assisted by the Committee on Publications of the Franklin Institute.

THIRD SERIES.

Vol. XXIII.

WHOLE NO. VOL. LIII.

PHILADELPHIA:

PUBLISHED BY THE FRANKLIN INSTITUTE, AT THEIR HALL.

1852

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JANUARY, 1852.

CIVIL ENGINEERING.

*Extract from the Report of the General Board of Health respecting the Metropolis.—Water Supply and Drainage of Towns.**

The Board have inquired fully into that essential point—What are the qualities of water the most conducive to health, and to economical employment for domestic and manufacturing purposes?

On this question the Board refer to a great mass of evidence; and first, as to the effect of lime contained in water.

It cannot be gathered from the evidence that, excepting in calculous disorders, a small quantity of lime in water has been *proved* to be injurious to health, though it has always been suspected of being insalubrious, and is thought to be so by many of the witnesses.

The Report states that Professor Clark has invented the term of *degrees of hardness;* this will doubtless be found to be of great practical convenience. One degree of his lime scale, as it may be called, denotes that one grain of carbonate of lime is contained in a gallon of water; the several higher degrees of hardness denote that for as many as are the degrees marked, so many are the grains of carbonate of lime contained in each gallon of water.

That lime injures water for all economical purposes is fully proved, as also for most manufacturing processes, "but the natives of London are very little aware of it." We find no attention paid to it in any of the "schemes for water supply which have obtained the aid of parochial Boards."

Hardness is unfavorable to all culinary operations; thus, according to

* From the London Mechanic's Magazine, for September, 1851.

M. Soyer's evidence, hard water gives a yellow tinge to vegetables boiled in it, and gives them a shrivelled appearance. Hard water "does not open the pores of meat so freely as soft water does." Infusions of all kinds are stronger when made with soft water than with hard; so that tea made with water of 6½ degrees of hardness requires nearly a third less of the tea than when made with water of 16 degrees of hardness, being about that of Thames water. This evidence was corroborated by that of Mr. Philip Holland and of Professor Clark. Hard water requires more fuel than soft to raise it to a boiling heat. Hard water occasions greater expense than soft in washing, on several accounts; as the greater quantity of soap or of soda required, the extra labour in washing, the greater wear and tear of the clothes themselves. "As far as the home market is concerned," "more money is expended in washing than in the manufacture of the fabric, or of the clothes themselves." In London, "before a shirt is worn out, five times as much money as it originally cost will have been expended on it in washing." The alkalies and mineral ingredients used in washing with hard water never fully leave the clothes.

The data on which the Board calculate the expense of mere washing are the only ones throughout the whole Report that appear to be erroneous; in this instance they seem to be so, because the prices stated for washing—whether by the piece, or from the weekly average expenditure of individuals or families—are not for washing alone, but include the charge for expenses incurred in collecting linen, drying, and folding it, mangling some of the articles, ironing several of them, starch, blue, &c.; which items constitute together at least half the expense of laundry-work. The oversight in this respect does not, however, invalidate the strong testimony given of the increased cost on several accounts occasioned by washing in hard water.

From Mr. Donaldson's evidence, it appears that for every 100 gallons of water used, 2 oz. of hard soap are required to soften it for each degree of hardness; thus water of 5° of hardness requires 10 oz. of soap; if the water be of 15° of hardness, 30 oz.

The amount of the money expended for washing in the metropolis was another inquiry. According to one estimate the washing bills in London rise to the enormous sum of 5,000,000*l.* a year, at the average rate of little more than a shilling a head per individual for the whole population. This the Board seem to think excessive,—and, indeed, it appears to be so; the masters in some families may, indeed, spend even more than five shillings a week in laundry work, as specified in the calculations; but the laundry expenses of the greater portion of the industrious classes do not amount to more than sixpence a head a week,—and this description of persons form the great bulk of the metropolitan population.

Soft water is more agreeable and effective than hard for baths, and for all purposes of the toilette. Several witnesses affirm that, as a beverage soft water is more agreeable than hard; though those accustomed to hard water become reconciled to its use.

There are many manufactures that cannot be advantageously carried on with hard water; hence several of the great London brewers have, at a heavy outlay, caused deep wells to be dug on their premises for the purpose of obtaining water that is soft.

The water of the Thames supplied to London is stated to be of from 14 to 16 degrees of hardness, and that of the other rivers and streams which contribute to the supply of London is about equally hard. The Board have had 424 different specimens of water tested; they were taken from different distant places. Water from wells and springs averaged nearly 26 degrees of hardness; that from rivers and brooks 13 degrees; that from land and surface drainage not quite 5 degrees. About 26 tons of lime are delivered in the metropolis *daily*, mixed or dissolved in the water with which it is supplied.

Professor Clark has indicated an economical means of depriving water of its carbonate of lime by means of quick lime; and Mr. P. Holland describes a mode of farther purifying it by the addition of "a little oxalate of ammonia, or of soda."

A mixture of other inorganic impurities in water, such as iron, or clay, is prejudicial for all economical purposes; but, excepting after floods, being seldom found in considerable quantity in any of the waters with which towns are supplied, little notice is taken of such impurities.

The Board's inquiries respecting organic impurities are extensive and important. By the information they have elicited, it does not appear that animals and vegetables usually inhabiting water are, whilst in a *living* state, insalubrious; but that, when in a state of decomposition, they render water containing them highly injurious to health. The evidence on this head proves the fact incontestibly. Organic matters, when in that state, produce disease taken internally as a beverage, and also when the gases arising from them are inhaled. A remarkable instance of the former is given by Dr. Gavin:—"A thirsty navigator drank of the Hackney brook, and was almost immediately attacked with cholera, and subsequently speedily died." The instances adduced are innumerable of the deleterious effects of the emanations from water rendered putrid by the decomposition in it of organic matter; but "chemistry has not to the present moment succeeded in isolating those substances, or in characterizing them by particular reactions." Water got at Hungerford market contained in a gallon above 13 grains of volatile and organic matter in suspension, besides 43 grains of inorganic matter. When that water was boiled down, it emitted a strong acid smell, and when heated, a smell like that of burning wood. Exclusively of epidemic periods, "in ordinary times it is known that troops who have drank water polluted with animal or vegetable matter in a state of decomposition are peculiarly subject to dysentery."

The *boiling* of water appears to greatly diminish the deleterious effects of such water. "There was the case of a man who lived in the Coburg-road, Camberwell parish, in a semi-detached house, in a healthy situation, and with a garden behind the premises. His wife had noticed that the water supplied to them was exceedingly bad; and having been informed that it was likely to affect the health of her family, she invariably boiled and filtered it. All kept in perfect health except the father, who objected to drink this water from its being flat and unaërated: he would still drink it as it came from the water-butt, and the consequence was that he was attacked with choleraic diarrhœa; he afterwards drank no more of it, and got well."

It is shown that lead is more corroded by pure than by impure water; but it has been unexpectedly found that filtration through sand separates the lead.

These preliminary inquiries having been gone through, as to the economical and the sanitary qualities of different waters, the next question to be considered is, From what source can London be supplied with water that shall be the most free from vitiating matters?

The Board report, that "The qualities for the water supply of the population appear to range themselves in the following order:

"1st, Freedom from all animal and vegetable matter.

"2d, Pure aëration.

"3d, Softness.

"4th, Freedom from earthy, mineral, or other foreign matters.

"5th, Coolness in delivery at a minimum temperature,—neither warm in summer nor excessively cold in winter.

"6th, Limpidity or clearness."

To the above are added, as popular tests, that all special flavor or taste in water is objectionable.

A great mass of evidence is brought forward in proof that the streams from which London is supplied with water, *before* they come to be charged with sewer-water, already contain a vast quantity of animal and vegetable matter; that it is not any one of those streams but all of them, that are polluted with it,—the Thames itself to an excessive degree. That though the Thames and its tributaries be largely derived from land-springs through chalk strata, their water is in a turbid state when delivered, much of this turbidity being occasioned by animal and vegetable matter so completely in chemical solution that the common filters will not remove it; and it appears that the water of the New River, and of the water companies generally, is also charged with impurities of the same nature.

"We must state, as our conclusions upon this topic of inquiry, that if the water of the Thames could be early protected from the sewerage of all the towns draining into it, and from the sewerage of the metropolis, —if it could be purified from animal and vegetable matter as completely as deep well water, or as some of the surface water from the chalk districts, as proposed by Captain Vetch,—we should nevertheless feel compelled, upon the evidence recited, to pronounce water of such degrees of hardness to be ineligible for the supply of the metropolis, and to recommend as we now do,—"That the water of the Thames, the Lea, the New River, the Colne, and the Wandle, as well as that of the other tributaries and sources of the same degrees of hardness, should be as early as practicable abandoned.

"Deep well-water is free from surface animal and vegetable impurities, but it has generally more of mineral impurity, and is usually unobtainable in sufficient quantity at a moderate expense."

Since the number that has been made of deep wells in the metropolis of late years, it seems certain that the supply from this source would be inadequate to the wants of London. Already great brewers have arranged amongst themselves to brew respectively on different days, so as to equalize the demands on the water-bed; it is further stated that water is higher

in the wells on Mondays than on any other days, by reason of there being no brewing on the Sunday. This difference in the level of the water-bed is felt as far from town as Tottenham.

"Seeing the disadvantages inseparable from river and well-water, attention has been directed to other sources of supply." Professor Clark states that "nowhere has there been made such important improvements in the collection and purification of water supplies as in Lancashire."

"The improvement in the collection is due to the application of the principle we have above stated; that is to say, that the nearer to the actual rain fall the water is collected, the freer it will be from adventitious impurities. The new practice in Lancashire has been to take some elevated ground,—generally sterile moor land, or sandy heath; and to run a catch water trench or conduit round the hill, midway, or as high up as may be convenient for the sake of fall, regard being had to the space of the gathering-ground. An embankment is thrown across some natural gorge, at the nearest point at which a reservoir may be formed without the expense of excavation. Into this the rain water is led, and stored, to be used in dye or print works, or for other manufacturing purposes, having in many instances been previously filtered. The economy and efficiency of these filters, which merely act as strainers, are much praised by Professor Clark. They serve to show, however, how much more economically filtration may be conducted on a large than on a small scale; and how sordid and erroneous is the administration, whether of water companies, or of local Boards, which neglects or refuses filtration of the supplies used for the general population. But until recently, with the exception of a very small proportion, the supply of towns was delivered without any previous filtration whatsoever, and more than half the supply of the metropolis is still so delivered.

"The new process of land-drainage furnishes a means for the filtration and depuration of impure water on a large scale, with considerable advantages over the larger sand strainers or common filters." "Where the drains have been tolerably well adjusted, the water from this deep drainage is seen running away perfectly pellucid. Where there happen to be two branch outfalls into one main,—the one a branch outfall from mere surface drained land, the other an outfall from thorough drained land,—the water from the thorough drained land may be seen running perfectly limpid, whilst the water from the surface drained land runs away turbid, and of the color and consistency of pea-soup, from the inorganic or organic particles which it contains."

The Board caused to be tested 424 specimens of water from different parts of the country. The results were as follows:

From wells and springs, average hardness,	25·86
" rivers and brooks, average hardness,	13·05
" land and surface drainage, average hardness,	4·94

The Board were early desirous of investigating what matters were taken up by water passing through different sorts of soils, but the College of Chemistry declined the task; lately, however, "the examination has been made by Professor Way, with most important results." From this examination it will be seen, that clays and loams have powers of chemi-

cal action for the removal of organic and inorganic matters from water to an extent never before suspected, and that it will be practicable to use agricultural drainage arrangements on gathering grounds, as means of filtration and more complete purification of water on a larger scale than is at present accomplished."

To be Continued.

On Ventilation by the Parlor Fire. *By* WILLIAM HOSKING, ESQ., *Professor of Architecture and of Engineering Constructions at King's College, London.**

The term ventilation does not strictly imply what we intend by its use in reference to buildings used as dwelling-houses, or otherwise for the occupation of breathing creatures. To ventilate is defined "to fan with wind;" but one of the main objects for which houses and other enclosed buildings are made, is shelter *from* the wind. Inasmuch, however, as the wind is but air in motion, and we can only live in air, air may not be shut out of our houses, though, for comfort's sake, we refuse to admit it in the active state of wind. But in doing this—in shutting out the wind—we are apt to put ourselves upon a short allowance of air, and to eke out the short allowance by using the same air over and over again.

There is a broad line of distinction, indeed, to be drawn between in-door and out-door ventilation; for although the principles upon which nature proceeds are the same, the operation is influenced by the circumstances under which the process may be carried on. Whether it be on the hill-side, open to the winds of heaven, or in a close room, from which all draft of air is excluded, the expired breath, as it leaves the nostrils heated by the fire in the lungs, rises, or seeks to rise, above their level, and may not be again inhaled. Out of doors the cooler or less heated air of the lower level presents itself for respiration unaffected by the spent exhaled air, but in a close apartment, the whole body of included air must soon be affected by whatever process any portion of it may have undergone. The process by which nature carries off spent air, purifies, and returns it uncontaminated, is thus checked by the circumstances under which we place ourselves within doors. All our devices for shelter from the weather, and for domestic convenience and comfort, tend to prevent the process provided by nature from taking effect according to the intention in that respect of the Creator. We not only confine ourselves, indeed, and pen up air in low and close rooms, but we introduce fire by which to warm the enclosed air; wanting light within our dwellings when daylight fails, we introduce another sharer in the pent-up air of our rooms, being fire indeed in another form, but generally under such circumstances, that it not only abstracts from the quantity, but injures the quality of what may remain. But fire, whether in the animal system, in the grate, or in the lamp, cannot long endure the imagined limitation of air. There must be access of air—of vital air—by some channel or other, or the fire will go out.

* From the Edinburgh New Philosophical Journal, October, 1851.

An open fire in the grate must however have a vent for some of its results, or it will be so disagreeable a companion that its presence could not be endured, even as long as the most limited quantity of air would last; and the fire will compel the descent of air by the vent commonly supplied under the name of a flue—a chimney flue—to render its presence tolerable in a closed room, if a supply be not otherwise obtainable. But as the outer air at the higher level of the top of a chimney, because of the rarity of the air in and above the flue, responds to the demand of the fire less easily than the lower air, or that at and about the level of the fire; and the lower air, or air at the lower levels, forces its way in, therefore, by any opening it can find or make—through the joints of the flooring-boards, and under the skirtings—the supply passing first up or down the hollow lathed and plastered partitions, sometimes even up from the drains; and through the joints under and about the doors and windows. If these channels do not exist, as they may not when the joiners' work and the plastering are good, or when the open joints referred to are stopped up by any means, the fire smokes, and every known means of curing the chimney failing, means are sought of obtaining heat without the offending fire. Ventilation is not thought of yet.

The open fire may be made to give place to the close stove or to hot-air pipes, to hot-water pipes, or to steam-pipes—which make hot the air about them in a close room without causing drafts. But the warmth obtained in pipes is costly under any circumstances. Air does not take up heat freely, unless it be driven and made to pass freely over the heated surface; and there being little or no consumption of air, and consequently little or no draft, in connexion with heated bodies, such as close stoves and hot pipes, the heat from them is not freely diffused, and is not wholesome. There is with all the expense no ventilation.

Stoves and hot pipes are, moreover, exceedingly dangerous inmates in respect of fire. Such things are the most frequent causes, directly or indirectly, of fires in buildings. Placed upon, or laid among or about the timbers and other wood-work of hollow floors, and hollow partitions, and in houses with wooden stairs, more conflagrations are occasioned by hot pipes and stoves, than by anything else, and perhaps more than by all other things together.

Open stoves with in-draft of air warmed by being drawn quickly (when it is drawn quickly) over heated surfaces, may be made part of a system of safe and wholesome in-door ventilation; but to be perfect there must be also out-draft with *power* to compel the exit of spent or otherwise unwholesome air. But the arrangements for and connected with such stoves are special, and therefore costly, unless the buildings in which they may be employed have been adapted in building to receive them. And in-draft stoves may, however, be applied with great advantage as it regards the general warmth and ventilation, in the lowest story of any house, if there be compelled out-draft at the highest level to which it will naturally direct itself if it be not retained, so that the in-drafted air, tempered as it enters, may be drawn out as it becomes spent, or otherwise contaminated.

But this must be considered in all endeavors to affect in-door ventilation, or the endeavor will fail. *The air must be acted upon, and not be*

left, or be expected, to act of itself, and to pass in or out as may be desired, merely because ways of ingress and egress are made for it. Make a fire in a room, or apply an air-pump to the room, and the outer air will respond to the power exerted by either by any course that may be open to it, and supply the place of that which may be consumed or ejected; but open a window in an otherwise close room, and no air will enter; no air can enter, indeed, unless force be applied as with a bellows, whereby as much may be driven out as is driven in, with the effect only of diluting, not of purifying. Even at that short season of the year in which windows may be freely opened, unless windows are so placed as to admit of the processes of out-door ventilation being carried on through them by a thorough draft from low levels to high levels, open windows are not sufficient to effect thorough in-door ventilation. There must for this purpose be in every room a way by which a draft can be obtained, and this draft must take effect upon the most impure air of the room, which is that of the highest level. The chimney opening may supply a way at a low level, and a draft may be established between it and the window, but the air removed from the room by such a draft is not necessarily the spent or foul air. But make an opening into the chimney flue near the highest level in the room, that is to say, as near as may be to the ceiling, and if a draft be established between the window and the flue by this opening, the ventilation is complete; that is to say again, if there be draft enough in the chimney flue from any cause to induce an up-current through it, or if there be motion of the external air to drive the air in at the window and force an up-current through the flue.

Windows may not be put open in the long enduring colder season, however, and for the same reason in-drafts of the outer air by any other channel are offensive and injurious. To open a door for the sake of air is but a modification of opening a window, and, if the door be an internal one, with the effect of admitting already enclosed, and, probably, contaminated air. Means of efficient in-door ventilation must therefore be independent of windows and doors; and the means should be such as will lead to a result at once wholesome and agreeable.

Many plans have been suggested, and some have been carried into effect, of warming air, and then forcing it into or drawing it through buildings, and, in the process of doing so, removing the foul or spent air from the apartments to which it may be applied. Some of these plans are more and some are less available to wholesome and agreeable in-door ventilation, but even the best are rather adapted to large apartments, such as those of hospitals, churches, theatres, and assembly-rooms, than to private dwelling-houses in which the rooms are small and labor and cost are to be economized.

Plans have been proposed, too, for the economical ventilation of dwelling-houses; but they seem to be all in a greater or less degree imperfect. Ways of access are provided in some cases for the outer air directly to the fire in every apartment, to feed the fire, and indirectly to ventilate the room; way of egress in addition to the chimney opening and the chimney flue being sometimes provided for the spent air of the room; sometimes, indeed, as before indicated, by an opening into the chimney

flue near the ceiling. A direct in-draft of cold air is not agreeable, and it may be pernicious, but if the outer air become warm in its way to the inmates of the room, the objection to its directness ceases. If, however, the warmth is imparted to it with foulness, the process does not fulfil the condition as to wholesomeness, and this is the case, when the outer air is admitted at or near to the ceiling to take up warmth from the spent and heated atmosphere of the higher levels. Having undergone this process, it is not the fresh air that comes warmed to the inmates, but a mixture of fresh and foul air that cannot be agreeable to any inmate conscious of the nature of the compound.

The endeavor on the present occasion was to show how the familiar fire of an apartment may be made to fulfil all the conditions necessary to obtain in-door ventilation, to the extent at least of the apartment in which the fire may be maintained, and while it is maintained.

A fire in an ordinary grate establishes a draft in the flue over it with power according to its own intensity, and it acts with the same effect, at least, upon the air within its reach, for the means which enable it to establish and keep up the draft in the flue. The fire necessarily heats the grate in which it is kept up, and the materials of which grates are composed being necessarily incombustible, and being also ready recipients and conductors of heat, they will impart heat to whatever they may be brought into contact with them.

It is supposed that the case containing the body of the grate is set on an iron or stone hearth in the chimney recess, free of the sides and back except as to the joints in front. Let all communication between the chamber so formed about the back and sides of the grate and the chimney flue be shut off by an iron plate, open only for the register flap or valve over the fire itself. External air is to be admitted to the closed chambers thus obtained about the grate by a tube or channel leading through the nearest and most convenient outer wall of the building and between the joists of the floor of the room, to and under the outer hearth or slab before the fire, and so to and under the back hearth in which sufficient holes may be made to allow the air entering by the tube or channel to rise into the chamber about the fire-box or grate. Openings taking any form that may be agreeable are to be made through the cheeks of the grate into the air-chamber at the level of the hearth. In this manner will be provided a free inlet for the outer air to the fire-place and to the fire, and of the facility so provided the fire will readily avail itself to the abolition of all illicit drafts. But the air in passing through the air-chamber in its way to the fire which draws it, is drawn over the heated surfaces of the grate, and it thus becomes warmed, and in that condition it reaches the apartment.

An upright metal plate set up behind the openings through cheeks of the grate, but clear of them, will bend the current of warmed air in its passage through the inlet holes, and thus compel the fire to allow what is not necessary to it to pass into the room; and if the opening over the fire to the flue be reduced to the real want of the fire, the consumption of air by the fire will not be so great as may be supposed, and there will remain a supply of tempered air waiting only an inducement to enter for the use of the inmates of the apartment. An opening directly from the

room into the flue upon which the fire is acting with a draft more or less strong, at a high level in the room, will afford this inducement; it will allow the draft in the flue to act upon the heated and spent air under the ceiling, and draw it off; and in doing so will induce a flow of the fresh and tempered air from about the body of the grate into the room.

The mode thus indicated of increasing the effect of the familiar fire, and making it subservient to the important function of free and wholesome ventilation, is not to be taken as a mere suggestion, and now for the first time made. It has been in effective operation for six or seven years, and is found to answer well with the simple appliances referred to. But it is the mode and the principle of action that it is desired to recommend, and not the appliances, since persons more skilled in mechanical contrivances than the author professes to be, may probably be able to devise others better adapted to the purpose.*

The mode referred to of warming and ventilating apartments by their own fires is most easy of application, and in houses of all kinds, great and small, old and new, and as the warmth derived from the fire in any case, comes directly by the in-drafted air, as well as by radiation of heat into the air of the apartment, fuel is economized. If the register flap be made to open and shut, by any means which give easy command over it, so that it may be opened more or less according to the occasion, and this be attended to, the economy will be assured; for it is quite unnecessary to leave the same space open over the fire after the steam and smoke arising from fresh fuel have been thrown off, as may be necessary immediately after coaling. The opening by the register valve into the flue may be reduced when the smoke has been thrown off, so as to check the draft of air through the fire, and greatly to increase the draft by the upper opening into the flue, to the advantage of the ventilation and to the saving of fuel, while the heat from the incandescent fuel will be thereby rather increased than diminished.

Moreover the system being applicable in the cottage of the laborer, as fully and easily as in the better appointed dwellings of those who need not economize so closely as laboring people are obliged to economize, the warmed air about the grate in a lower room may be conveyed directly from the air-chamber about the grate by a metal or pot pipe, up the chimney flue, and be delivered in any upper room next to the same flue and requiring warmth and ventilation, the process of ventilation applied to the lower room being applicable to the upper room also.

The indicated means by which winter ventilation is obtained are not of course equally efficient in summer, for the draft of the fire is wanting; but the inlet at the low level for fresh air, and the outlet for the spent air at the upper level continuing always open, the heat which the flue will in most cases retain through the summer aided by that of the sun's rays upon the chimney top, secures a certain amount of up-draft, which is not without its effect upon the in-draft by the lower inlet even when windows and doors are shut.

While it is obvious that the air drawn into any house for the purpose

* The appliances used by Mr. Hosking will be found more fully described in his "Healthy Homes," published by Mr. Murray.

of in-door ventilation need not be other than that which would enter by the windows of the same house, it may be necessary to enter into an inquiry as to the condition of the air heretofore spoken of as fresh and pure. "Fresh" and "pure" applied to air must be taken to mean the freshest and purest immediately obtainable, and that will be the same whether it be drawn in through a grated hole in a wall, or by a glazed opening closed by it in the same wall. But it is a fair subject for inquiry, whether,—speaking in London to Londoners,—the air about our houses in London is as pure,—or as free from impurity—as it might be.

The out-door ventilation of large towns may be taken to be more complete above the tops of the houses and of their chimneys than it is, or, perhaps, can be among and about the houses. The processes of nature are there not only unchecked, but are in fact aided by the heat thrown up by the chimneys into the upper air, and impurities which can be passed off by chimney flues, will be more certainly and more effectually removed and changed by Nature's chemistry, than if they are kept down to fester under foot and to exhale in our streets and about our doors and windows.

At this time every endeavor is made to provide for removing from our dwellings all excrementitious matter, and all soluble refuse, by drains into sewers, and so by the sewers to some outfall for discharge. The drain necessarily falls towards the sewer, and the sewer again to its outfall, and the sullage or soil drainage being rendered liquid thus passes in the usual course. But the usages and the necessities of civilized life cause a arge proportion of the liquid refuse from dwelling-houses to pass off in a heated state, or to be followed by hot water arising from culinary processes, and from washing in all its varieties. The heat so entering the drains causes the evolution of fetid and noxious gases from the matters which go with, or have gone before, the hot water; and with these gases house-drains almost always, and sewers commonly stand charged. They are light fluids, and do not go down with the heavy liquid matters from which they have been evolved, but they seek to rise, and constantly do rise in almost every house through imperfections or derangements of the flaps and traps which are intended to keep them down, but which only, when they do act, compel some of the foul air to enter the sewers, and there to seek outlet to the upper air, which they find by the gulley gratings in the streets.

It can hardly be said perhaps that *too much* attention has been given of late to the scour of sewers by water; but it is most certain that too little attention has been given to the consideration last stated, for nothing has been done to relieve the drains and sewers of their worst offence. The evolution of foul and noxious gases in the *drains* is certainly not prevented by scouring the *sewers*. In the meantime the poison exists under foot, and exudes at every pregnable point within and about our houses, and it rises at every grating in our streets, though the senses may become dull to them by constant suffering.

Now this is an evil which can be greatly ameliorated, if it cannot indeed be wholly cured; but it is by a process that, to be effective, must be general, and, therefore, it must be added compulsory. The process is of familiar application in the ventilation of mines, and particularly of

coal mines. An up-cast shaft containing a common chimney flue carried up at the back of every house, and connected with the house-drains at their highest level, would give vent to the foul air in the drains, and discharge it into the upper air. The foul air evolved by heat expands, and expanding it rises, and rising it would be followed by cold air settling down by the gulley gratings in the streets, thus constituting their inlets downcast shafts, and the sewers and drains themselves channels for the currents setting to the up-cast shafts, by which they would be relieved. The down draft into the sewers would carry with it much soot and fine dust, which would settle upon the liquid current and pass off with it, and so remove some of the tangible as well as the intangible impurities before referred to, from the air in our streets and about our houses.

Much in this way might be effected by the aid of causes in constant operation; but if the up-cast shaft to every house were also a fire-flue, or were only aided by the draft of a neighboring fire, the up-current would be sufficient not only to prevent the house drains from retaining foul air, but the foul air would be thrown off into the upper air with better effect, and be dissipated innocuously and without offence, instead of steaming as it now does from the sewers into the air where it cannot be avoided.

---

*Description of Mr. Brunel's Bridge over the Wye.**

In the Exhibition is a model of a new kind of bridge, between a suspension and a tubular bridge, in the course of construction to span the river Wye, at Chepstow, invented by Mr. Brunel, the engineer of the South Wales railway.

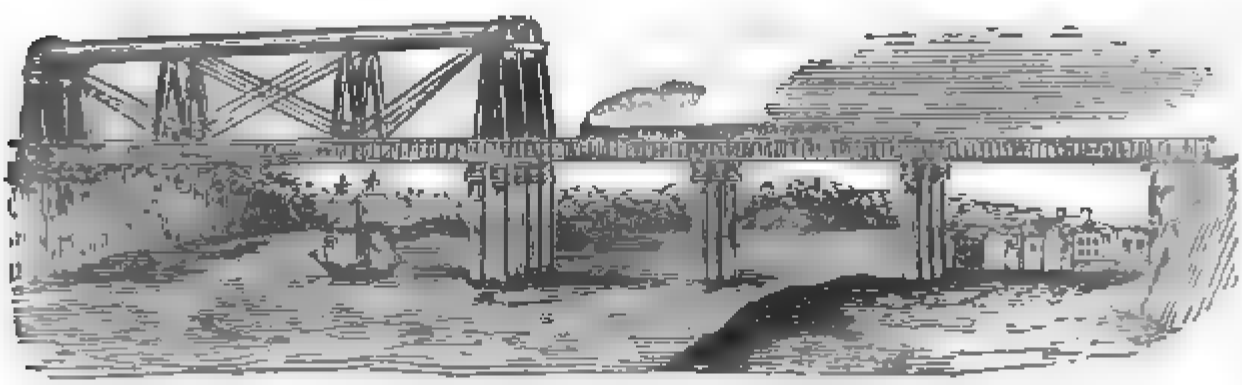
Every one knows what the Britannia bridge is across the Menai, at Bangor. It consists of two rectangular tubes, each of which has for the sake of strength, a sort of cellular or double top and bottom. The strongest and most essential part of this bridge is said to be the top. Mr. Brunel's Wye bridge is, as far as regards the roadways, two tubes without the tops. But to supply the tops he has, for each roadway, a hollow cylinder of iron suspended some distance above the roadway on piers. From the extremities of the cylinder on the piers, a chain loop runs under four pins on each side of the roadway for the purpose of helping to support it. Besides these loop chains there are two strong upright braces, one on each side, tying the iron cylinder to the outsides of the roadway, and from the top of each of these side braces to the bottom of the other another chain is drawn. Neither the utility nor the action of these brace chains have we been able to discover. But the loop chains are ingeniously contrived to give strength to the bridge with the least weight to the supporting cylinders. For by the loop chains coming from the points where the cylinders rest on their supports, if we suppose the tensile forces acting on each chain according to the rules of mechanics to be resolved into two, one pressing perpendicularly on the supports, the other must be in the direction of the cylinder, that is, endeavoring to compress it lengthwise, and therefore is in a direction which the cylinder is best able to sustain.

* From the London Railway Journal, No. 644.

With regard to the ties or braces before mentioned, and their diagonal chains, we have our doubts of their utility. They appear to us to be useless, while the braces or ties, should the bridge yield to the weight, will sink the middle of the cylinder with them, and consequently weaken it to sustain the opposite compressing forces of the loop chains at the extremities.

The span of the bridge is 290 feet; the height of the roadways 70 feet above high water mark. On the east or English side, the roadways rest on a rock, and on the Chepstow side on six upright iron cylinders, tapering, we believe, a little towards the bottom, and filled with concrete. Towards the west the roadways are continued, supported on cylinders filled with concrete, in the shape of a viaduct, for about 300 feet more, but without the sustaining cylinders. Each of the two roadways is independent of the other.

The *tout ensemble* of the bridge is light and elegant, as we judge from a model of it in the Exhibition. Externally it will have a much better effect than the tunnel tubes across the Menai, and will be more pleasant to the passengers from being open. Sailing up or down the Wye, the bridge will form a pretty addition to the picturesque scenery. It is now in the course of structure, and will probably not be completed for 12 months onwards. The total length of the bridge and viaduct is 623 feet; the clear water span for vessels 290 feet, with a headway of 70 feet at spring tides. The cylinders are 50 feet above the roadways. Beneath we give a drawing of the bridge as it will appear when finished, with the adjacent country.



AMERICAN PATENTS.

List of American Patents which issued from November 11, to December 2, 1851, (inclusive,) with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.

21. For an *Improvement in Cheese, Butter, and Bread Cutters;* Benjamin F. Adams, Bangor, Maine, November 11.

Claim.—"What I claim as my invention is, the arrangement of the circular revolving table and knife; the said knife being attached to the sliding shaft, and operated by means of a treadle and weighted cord and pulley, or other equivalents, so that the cheese or other article to be cut may be placed upon the table, and not removed until, by a single revolution of the wheel, and a few slight pressures of the foot upon the treadle, it is cut into as many parts as may be desired, without crumbling or waste."

22. For an *Improvement in the construction of Scythe Fastenings;* David Anthony, Sr., Springfield, New York, November 11.

"The nature of my invention consists in attaching the scythe to the snath, in such a manner that the point may be thrown out or in, with the greatest possible facility."

Claim.—"Having thus described the nature of my invention and the manner in which it is constructed, what I claim as my invention is, the mode of adjusting the lever by rotating the ring around its own axis, by which the point of the scythe is thrown out or drawn in, as shown and described, the upper end of the lever passing through an eye attached to the ring, the fulcrum of the lever being near the end of the snath as shown, and the scythe attached to the lower end of the lever as set forth."

---

23. For an *Improvement in Hand Planes;* Benjamin F. Bee, Harwick, Massachusetts, November 11.

Claim.—"What I claim as my invention is, the application to carpenter's planes and moulding tools, of a new method of confining the iron, by a metallic apparatus, acting upon the principles of the lever and cam, in combination with the set screw, for adjusting the same, as herein described; using for the purpose, the aforesaid contrivance, or arrangement of parts, or any other substantially the same, and which will produce the same effects in like manner."

---

24. For an *Improvement in Screens for Winnowing Machines;* Jonathan Bean, Montville, Maine, November 11.

Claim.—"I do not claim any part or portion of the gear, fans, or forms of the hopper, or shoe, as an original invention, as I am aware that all these have been in common use; but what I do claim as new is, the arrangement of guides and side apertures in the upper movable screen, as seen in figure 3, and the lower screen, as seen in figure 4, attached to the shoe, and which screen may be attached to any common winnowing machine, in the manner and for the purposes before described."

---

25. For an *Improvement in Stave-Jointing Machines;* Daniel Drawbaugh, White Hill P. O., Pennsylvania, November 11.

Claim.—"What I claim as my invention is, the adjustable knife, in combination with the adjustable rest, as described, to adapt them to the jointing of staves for casks of different bilge."

---

26. For an *Improvement in Shuttle Motions of Looms;* George W. Perry, Thompson, Connecticut, November 11.

"My invention consists in hanging the picker staves, each on two radius rods, which are attached to fixed centres, on the swords, or frame of the lay, being connected by joint pins, one at the lower end and the other at a suitable distance from it. The effect produced by this arrangement being to cause the end of the staff, which acts upon the shuttle, to move in a right line, parallel to the raceway—the two radius rods producing a parallel motion, without the aid of any other device for guiding or controlling it."

Claim.—"Having thus described my invention, I do not claim hanging the picker staff on a radius rod, as I am aware that it has been so hung, and by the aid of other devices, in connexion, a motion parallel to the raceway has been produced; but what I do claim is, hanging the picker staff, or staves, upon radius rods, having two distinct radial motions, substantially as herein set forth, for the purpose of causing the end which operates upon the shuttle to describe or make a rectilinear motion, parallel with the raceway, and with less power than has heretofore been done."

---

27. For an *Improvement in Machines for Cutting the Soles of Boots and Shoes;* Joseph Steger, Roxbury, assignor to William Mitchell, Boston, Massachusetts, November 11.

Claim.—"Having thus described my improvements, I shall state my claim as follows: What I claim as my invention is, the mode or means herein above described, for insuring

the unerring turning of the knife frame, for cutting both sides of the sole; said means consisting of the notched pawl lever and spring, *y*, *y*, operating on the journal plates of said frame, substantially as herein above described."

28. For an *Improvement in Car Seats;* Ezekiel Booth and Ezra Ripley, Troy, New York, November 11.

Claim.—"Having thus described the nature of our invention, what we claim as new is, the arrangement of two levers, in a cross position, so that any required height of back may be carried and reversed, from and to either side of the seat, and secure it firmly in its position, at any required angle, substantially the same as described and represented."

29. For an *Improvement in Telescopes;* Alvan Clark, Cambridge, Massachusetts, November 11.

Claim.—"What I claim as my invention or improvement consists in combining the glasses, or glasses and diaphragms, with a sliding or eye piece tube A of a telescope, by means of a tube or slide B, perforated through its side, or sides, in such manner as to enable a person, when the said tube B, is withdrawn from its enclosing tube, to obtain ready access through the openings or perforations, to the glasses or lenses; the whole being substantially in the manner and for the purposes as described."

30. For an *Improvement in Machines for Cutting Hides;* Jacob C. Flint, Boston, Massachusetts, November 11.

Claim.—"What I claim as my invention is, the combination of mechanism for reducing dry hide to a strip, and mechanism for cutting or removing the hair from the underside of the said strip at one continued operation, substantially in the manner as described."

31. For an *Improvement in Bending Felloes;* Andrew W. Johnson, St. Georges, Deleware, November 11.

Claim.—"Having thus described the nature and operation of my invention, what I claim is, the curbs C D, in combination with the box B, or its equivalent; said curbs being constructed in the manner and for the purpose substantially as described."

32. For an *Improvement in Card Grinders;* Richard Kitson, Lowell, Massachusetts, November 11.

Claim.—"What I claim is, an instrument for grinding or sharpening wool, cotton, or other cards, made with sectorial card teeth, which are so bent at the heel, as to make the sharp edge more prominent than its opposite and broad edge, together with its application to the card that is to be ground, in such a direction as to cause the sharp edge of the teeth of the grinder to be first presented to, and enter among the teeth of the card."

33. For an *Improvement in Daguerreotype Apparatus;* Wm. Lewis, Wm. H. Lewis, and J. Lewis, City of New York, November 11.

Claim.—"We claim, 1st, The construction of a camera box, with a cross opening, or mortise, to receive a sliding frame, that carries both an object glass and the daguerreotype plate, as described.

"2d, The construction and application of a sliding frame with a division to receive a frame carrying an oblong object glass, so formed as to be placed either vertically or horizontally, as described and shown.

"3d, The construction of the slide, so as to receive, in the other division, a daguerreotype plate in a frame, such frame being pressed in place by springs, and held in place by blocks taking notches in the frame, as described and shown."

34. For an *Improvement in Coupling Railroad Cars;* Lorenzo D. Livermore, Hartland, Vermont, November 11.

Claim.—"What I claim as my invention is, the combination of a stiff car coupling

with the ends of a couple of cars, and with the trucks under the same, substantially in the manner herein set forth, by which the cars are made to guide the trucks under them, and keep them in their proper positions on the track, to wit: in such positions, that a line drawn midway between and parallel with the truck axles, will be at right angles to any straight track, and also at right angles to the tangent of any curved railroad track."

---

35. For an *Improvement in Abdominal Supporters;* Allen J. Lonsbury, Somerville, Tennessee, November 11.

"The principal feature of this invention, and upon which its utility and excellence mainly depends, consists in the peculiar form of the front plate or pubic brace, and its peculiar connexions with other parts of the apparatus."

Claim.—"What I claim as my invention is, the employment of a pubic brace of the peculiar form herein described, and as represented in figures 2, 3, 4, 5, 6 and 7, of the drawings, so as to fit the os pubis, and press uniformly upon the inguinal region, while the upper edge of the brace is bent forward, so as to effect no inconvenient pressure upon the abdomen of the wearer; said pubic brace being made of hammered leather or other tenacious material, in the manner and for the purpose herein described."

---

36. For an *Improvement in Bedsteads;* Levi Newcomb, Jr., New Bedford, Massachusetts, November 11.

Claim.—"Having thus described the nature of my invention, and the manner in which it is constructed, what I claim as new is, the manner of securing the lower bedstead to the upper one, so that it may slide underneath the upper one, or drawn out from it, as described, viz: by having the clamps attached to the upper part of the foot posts of the lower bedstead, and clamps fitting in the recesses of the rails of the upper bedstead, and the rails of the lower bedstead passing through the mortise holes in the foot posts of the upper bedstead, substantially as shown and set forth."

---

37. For an *Improvement in Horse Collars;* Richard Rickey, Rutland, Ohio, November 11.

"The nature of my improvement consists, principally, in having two metallic plates, connected by a joint, so as to open and close with ease, and to be secured by two levers which are attached to their upper ends, and connected by a strap; these plates constitute the frame, or body of the two pads which press on the lower part of the shoulder, but do not reach up to the shoulder blade."

Claim.—"What I claim as my invention is, connecting the sides of the breast plate by a flat joint, in combination with the levers attached to the sides of the breast plate, and rising over the neck without touching the shoulders of the animal, and connected at the top, by which means the breast plate is made adjustable to the size of the horse, substantially as herein set forth."

---

38. For an *Improvement in Grain Kilns;* Isaac S. Stover, Erwinna, Pennsylvania, November 11.

Claim.—"What I claim as my invention is, the combination of the heating chamber, with the two drying beds, one above and the other below, as described."

---

39. For an *Improvement in Frosting Plates of Glass;* Isaac Taylor, City of New York, November 11.

Claim.—"What I claim as my invention is, the use of a rocker containing pebbles, sand, and water, for the purpose of frosting plates of glass, or embossed work, as above described."

---

40. For an *Improvement in Boot Trees;* Davis R. Hendrix, Pottstown, Pennsylvania, October 28.

"The nature of my invention consists in stretching boots or shoes, by regulating the set screws in the foot."

Claim.—"What I claim as my invention is, the set screws *m* and *n*, and plate *x*, in

combination with the screw g, substantially in the manner and for the purpose herein described and set forth."

41. For an *Improvement in Apparatus for Sizing and Dyeing Yarns;* Alonzo Bascom, East Jaffrey, New Hampshire, November 18.

Claim.—"Having thus described my improvements, I shall state my claims as follows: What I claim as my invention is, 1st, the conducting of yarn or thread, from section or warper beams, directly into and through the size or coloring liquids, to the pressure rollers, by a series of rollers, more or less in number, placed as nearly in contact with each other as the nature of the case will admit, the closer the better, sufficient space being allowed between the fixed rollers for the passage of the yarns or threads, thus enabling the said rollers to operate as guides to each and all the threads, to prevent them from matting or clinging together, and superseding the otherwise necessary use of reeds, raddles, or other separators.

"2d, I claim the taking or making of a weaver's lease, or series of leases, at the commencement of the process of warping or beaming of yarn or thread, on section or warper beams, and at proper intervals on the same, to correspond with required lengths of yarns, or threads, on weaving beams, and preserving the same throughout the sizing and drying; thus dispensing with the use of hacks, or lease takers, in the dresser, and the otherwise necessary stoppage of the dresser or sizer, for the purpose of tying or twisting together each separate thread."

42. For *Improvements in Printing Presses;* Thomas H. Dodge, Nashua, New Hampshire, November 18.

"The nature of my invention consists in hanging the platens and type beds of printing presses on cranks, on parallel shafts, which are so arranged that the platens and type beds are always parallel, or nearly parallel to each other, during the revolutions of the shafts."

Claim.—"Having thus fully described the nature, construction, and operation of my invention, I will proceed to state what I claim.

"1st, Hanging the type bed and platen upon cranks on rotating shafts, arranged and operating in the manner substantially as herein described.

"2d, The spring presser attached to the type bed, or platen, for the purpose of pressing the band e, communicating motion to the sheet, against the opposite surface of the platen or bed, and causing it to be moved at precisely the same speed as the bed and platen, substantially as described.

"3d, The arrangement for carrying and giving motion to the inking roller, consisting of the barrel P, the bars Q and p, the lever R, springs r and t, and band u, combined together and with the above type bed and platen, in the manner substantially as set forth."

43. For an *Improvement in Machines for Cutting Combs;* S. Curtis, Newtown, Connecticut, November 18.

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, the wheel B, with the cutters t, placed on its periphery, as described; said wheel having a rotary motion, and also a vertical reciprocating motion, in a transverse line with its axis, for the purpose of turning or cutting comb teeth, substantially as described; said motion being given the wheel by means of the cams, levers, and pawls, or their equivalents, as set forth."

44. For an *Improvement in Stove Grate Bars;* George W. Gardner, Albany, New York, November 18.

Claim.—"What I claim as new is, the manner described, of forming separate grate bars for vibrating grates, rounded at their ends, secured and working in grooves of the frame, as described."

45. For an *Improvement in Ploughs;* Henry Goldson, Greensborough, Mississippi, November 18.

"My invention consists of an implement, by means of which the surface of the earth

lying near to the cotton plants and the weeds growing therein, can be pared off in a thin slice, without injury to the roots of the plants, and thrown towards the centre of the open space between the rows."

Claim.—"What I claim as my invention is, a cotton scraper constructed as herein described, with a share and mould board, projecting from the side of the landside, opposite that to which the earth is thrown; the landside thus extending from the point of the scraper to that wing of the mould board opposite the one to which it usually extends, and the several parts being so arranged, that the landside will run deep enough to hold the implement firmly to its work, the share will pare the ground and cut off the weeds near the roots of the plants, and the mould board will conduct the same towards the middle of the space between the rows."

---

46. For an *Improvement in Propellers for Machinery to be Used in Currents;* James Hardie, Victoria, Texas, November 18.

Claim.—"I do not confine myself to the exact mode of gearing herein described, as many modifications of the same may be used, and answer equally well; but what I claim as my invention is, the application for the purpose specified, of one or more levers with the floats or blades at their lower ends, against which the current acts, said levers being attached at about their centres to an adjustable frame by an universal joint as described, the upper ends of the levers being attached to cranks, by which, through any suitable gearing, motion is communicated to the shaft substantially as described."

---

47. For an *Improvement in Railroad Car Wheels;* Nehemiah Hodge, Adams, Massachusetts, November 18.

"My invention consists in making a car wheel in not less than two concentric parts, and connecting these parts by vulcanized india rubber or other analogous elastic material interposed between them, whereby the annular or outer part of the wheel is insulated from the central or inner part, by a substance that will not transmit vibrations from the rim to the centre or axle of the wheel, whether such vibrations be lateral or radial in direction."

Claim.—"What I claim as my invention is, connecting the tread or rim of a car wheel to the hub or central part thereof, by means of india rubber or other analogous elastic material, such elastic material being connected with the outer periphery of the central part of the wheel by a groove on the latter or its equivalent, and to the inner periphery of the rim also by a groove thereon, or its equivalent; the india rubber holding itself in both grooves by its elasticity, and giving to the wheel lateral as well as radial elasticity, as herein described.

"I also claim the grooved segments, constructed substantially as herein described, and interposed between the india rubber and the rim, for the purpose of facilitating the insertion of the india rubber into the space between the rim and central part of the wheel, and its removal therefrom, as herein set forth."

---

48. For *Improvements in Mill for Grinding and Bolting;* Jehu Hollingsworth, Zanesville, Ohio, November 18.

Claim.—"Having first fully described the nature of my invention, what I claim therein as new is, 1st, the grinding of grain or other material by means of a revolving stone or metallic roller, and one, two, or more separately adjustable concaves, whereby "*high* and *low*" grinding may be performed simultaneously, and bolting the same the instant that any particles are ground fine enough, in combination with the returning on to the roller again, all particles too coarse to be bolted through the bolting concave, so that they may be ground over again and again, until they are fine enough to be discharged; and this I claim, whether it is done by means of the revolving beaters and brushes which throw it up and through the pipe, or by any other means essentially the same.

"2d, I claim the guide or partitions in the pipe as herein described, to prevent meal from scattering endwise in its transit from the bolting concave to the roller, in combination with the adjustable aprons on which it falls, and which distributes and governs it in its passage to the discharging end, as herein described and set forth."

49. For an *Improvement in Cannon for Throwing Chain Shot;* Adam Lemmer, Newark, New Jersey, November 18.

Claim.—"What I claim as new is, in combination with the revolving head, and the bores diverging as described, the rack attached to the gun, and the worm wheel hung on the shaft, by which the gun is made to revolve or turn to the desired position, so that the chain shot may be thrown either in a horizontal or vertical line."

---

50. For an *Improved Screw Propeller;* Gaspard Malo, Dunkirk, France, November 18.

"My invention consists in the employment for propelling vessels of a screw, composed of two or more series of movable vanes or wings; each series attached to a separate shaft, and the shafts placed one within the other, and provided with keys, or other equivalent means of connecting and disconnecting, so that the shafts can be turned on each other, for the purpose of placing the two or more series of vanes behind each other for sailing purposes, or at different parts of the circle, to increase the paddle surface when used for propelling."

Claim.—"And having now described the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim as my invention, is arranging two or more series of narrow blades, such as above described; each series on a separate shaft, and the shafts one within the other, and provided with keys or other equivalent means of securing them to each other, substantially as specified, so that the two or more shafts may be turned on each other, and resecured to place the series of vanes directly behind each other for sailing purposes, and at different points of the circle for propelling."

---

51. For an *Improvement in Desks;* Isaac H. Norris and David Flanders, Parishville, New York, November 18.

"The nature of our invention consists in constructing the top of the desk in two parts or pieces, each of which, situated side by side, is lowered and raised at pleasure by appropriate mechanical devices therefor, so that a proper level is easily obtained for either side of the book; and further, in the employment of a jointed leaf or leaves in the front of the desk, which when bent down or in, admit of the book being brought forward, and when raised up or out, form a rest for the hand."

Claim.—"What we claim as our invention is, 1st, forming the desk top in boxes, parts, or pieces, each of which may be separately raised or lowered, as required, through appropriate mechanical devices, substantially in the manner and for the purposes shown and set forth.

"2d, The employment of hinged double leaves in the front of the desk, the same when extended forming a rest for the hand, and being made capable of closing down or in, essentially as described."

---

52. For *Improvements in Railroad Switch;* David F. Phillips, Republic, Ohio, November 18.

Claim.—"Having thus described my invention and improvements in the self-adjusting and locking switch for railroads, I wish it to be understood that I am aware that the relative position of the switch with the main track, or turnout, or sideling track, has been changed by the action of mechanism attached to the cars, as well as by devices attached to the locomotive in various ways; and therefore, I do not claim changing the switch by apparatus or devices actuated by the cars or locomotive; nor do I claim constructing and operating a switch, composed of a single movable section of the main rail: but what I do claim as my invention and improvement is, the employment of the additional movable sections in combination with the sections forming the switch, whereby the lateral movement of each is halved or divided in opposite directions, and a more regular curve is produced than that resulting from the use of the single movable section or switch, and thereby insuring safety, the weight of the train of cars on one section of the switch, forming a lock to the other section, as one section cannot move without the other till the train of cars shall have passed therefrom, as herein fully set forth. I also claim the combination of the double central lever bars, with the central connecting rock shaft, having two cranks projecting in opposite directions, to which are attached the cross bars for uniting the

double sections, whereby the switch is adjusted, as fully set forth and shown in the drawings."

53. For an *Improvement in Seed Planters;* William Redick, Uniontown, Pennsylvania, November 18.

Claim.—"Having thus fully described my invention, what I claim therein as new is, the combination of the slides *f g*, with the grooves *a*, (which "drill in" the grain,) and the cells *c e*, so that by moving the slats *f* towards the centre of the hopper, to close the communication with the grooves and open it with the cells *c*, for planting in "check rows;" or by moving both the slats *f g* towards the centre of the hopper, to close the communication between said hopper and the grooves *a* and cells *c*, and open it with the cells *e*, for planting in "step-rows;" the whole being arranged in the manner and for the purpose herein set forth and fully shown."

54. For an *Improvement in Inserting Porcelain Teeth;* William Willshire Riley, Columbus, Ohio, November 18.

Claim.—"What I claim as my invention is, the mode of inserting teeth, by forming the concave base, and of inserting the platina pins into the base of the platina surface of the teeth in an oblique direction, and attaching them to the gum plate without stays."

55. For an *Improvement in Stoves;* Hale R. Rose, Guilford, Vermont November, 18.

Claim.—"What I claim as my invention is, placing the damper between the fire and hot air flues, so as to control the amount of opening in each respectively, and governing the same by the expansion of the rod substantially as herein described, for the purpose of regulating the heat of the oven. I do not claim the expanding rod irrespective of its connexion with the damper, placed as described."

56. For an *Improvement in Stove Grates;* H. J. Ruggles, West Poultney, Vermont, November 18.

Claim.—"Having thus fully described my new and improved fire chamber for stoves, &c., what I claim therein as new is, the inclined elevater for raising the back grate and coupling it with the front grate; and in combination, the connecting the front and back grates with hooks or catches, constructed and arranged substantially as above specified."

57. For an *Improvement in Spring Saddles;* John C. fr. Salomon, Cincinnati, Ohio, November 18.

"The nature of my invention consists in making a saddle tree with a movable pommel and cantle, which are connected with the pads by link joints, and with each other by a spiral spring or springs, and a raw hide covering, forming the seat."

Claim.—"What I claim as my invention is, the movable pommel, the spiral spring or springs connecting the pommel and cantle, and the raw hide seat, all combined substantially in the manner herein set forth, making a spring seat saddle tree."

58. For an *Improvement in Gongs;* Vine B. Starr, East Hampton, Connecticut, November 18.

"The nature of my invention consists in constructing gongs of sheet or plate iron, or steel, with a rim all round, strengthened by a ring or band, the whole being coated, having the crevices, interstices, and all unsound parts filled with a suitable alloy, say of copper and tin, for producing the desired sound or ringing tone."

Claim.—"What I claim as my invention is, making gongs of sheet or plate iron, or steel, with a rim all round, strengthened by a ring or band, the whole being coated, and having the crevices, interstices, and all unsound parts filled with an alloy of copper and tin, or any alloy of a similar nature, or compound of similar metals to what is usually called "bell metal," substantially as herein set forth."

59. For an *Improvement in Finishing and Balancing Millstones;* George Todd, St. Louis, Missouri, November 18.

Claim.—"What I claim as my invention is, the inserting the balance rine in the eye of a millstone, in the early stage of its construction, and then making use of the said balance rine, in conjunction with a chuck combined with the spindle, in completing the stone, substantially as herein set forth."

---

60. For an *Improvement in Wires for Making Pile in Woven Fabrics;* Erastus B. Bigelow, Clinton, Massachusetts, November 25.

"The nature of my invention consists in combining with the flat pile, or figuring wire, employed in the weaving of looped or piled fabrics, and attached to one end thereof, a weight projecting from the lower edge, so that when such wires are deposited in the open shed of the warps, and during the operation of beating up with the lay, the preponderance of the said weight will retain the wire in the proper position."

Claim.—"I do not limit myself to any particular form or mode of attaching the weight, as this may be variously modified. What I claim as my invention is, combining with the flat pile, or figuring wire, employed in weaving looped or piled fabrics, and attached to or near one end thereof, a weight, for the purpose and in the manner substantially as described."

---

61. For an *Improvement in Fastenings for Garments;* Elias Howe, Jr., Cambridge, Massachusetts, November 25.

"My invention consists of a series of clasps, united by a connecting cord, the said clasps running or sliding upon ribs formed of any suitable material."

Claim.—"Having thus described my improved mode of fastening garments, &c., I shall state my claim, as follows: What I claim as my invention is, the opening, closing, and fastening together, the two sides of a garment, or other article, by means of the clasps and ribs, operating in combination, substantially in the manner herein above described. I also claim the method of connecting the clasps, one to the other, in pairs, and in the series of pairs, by the links, cord and beads, substantially in the manner herein above set forth."

---

62. For an *Improvement in Cooking Stoves;* Hosea H. Huntley, Cincinnati, Ohio, November 25.

Claim.—"Having thus fully, clearly, and exactly described and represented my improvements in stoves, what I claim therein as new are, the diving flues opening from the floor, as described, and in combination with this, the chamber for the purpose described."

---

63. For an *Improvement in Cooking Stoves,* George W. Carleton, Brunswick, Maine, November 25.

"The nature of my invention consists in constructing a stove in such a manner, that it may be changed by adjusting some of its parts into an air-tight, or draft, wood, or coal cooking stove, cooking range, or a wood or coal draft, or air-tight radiating stove, or into a Franklin stove for wood or coal."

Claim.—"What I claim as my invention is, the employment of the three movable plates, C, D, E, constructed and arranged as described, viz: the plate E, being hollowed, affording a passage or flue, when not cut off by the damper, through which the heat passes, warming the ovens formed by the plates, the plates being capable of being withdrawn from the stove, or varied in a vertical position; by which arrangement the stove can be converted into an air-tight, or draft, wood, or coal cooking stove, cooking range, or a wood or coal draft, or air-tight radiating stove, or into a Franklin stove, substantially as set forth."

---

64. For an *Improved Safety Apparatus for Steam Boilers;* Jonathan and John I. G. Collins, Chester, Pennsylvania, November 25.

Claim.—"First, we claim as our invention, the bent tube formed and arranged substantially as described, to contain mercury, in combination with the lever of the safety

valve, or its equivalent, and connected with the steam boiler by means of a swivel and a pillar connexion, or its equivalent, whereby the varying pressure of steam varies the actual weight upon the valve.

"2d, We also claim the combination of the connecting rod Q, and the lever O, I, and the shaft R, for connecting the mercurial gauge T, T and U, with the catch box N, and projecture O, on the catch box, whereby the mercury in the gauge T, T, being the weight, holds down the safety valve, or sets it at liberty, by the pressure of steam from the pillar E, and swivel S, S, said pillar being supplied wi.h steam from the boiler or boilers, as described in the specifications.

"3d, We also claim the combination of the rod M, with the spiral spring upon it, and small pulley at the top of it, with the notched pulley L, for holding the catch box together, so long as the full part of the pulley L, is on the small pulley, or setting it at liberty, when that part of the pulley that is cut out comes opposite the small pulley, and thereby allowing it to ascend, as described in the specification."

---

65. For an *Improvement in Ploughs;* Elijah Goldthait, Fort Wayne, Indiana, November 25.

Claim.—"What I claim as my invention is, first, the cutter C^4, or its equivalent, to separate the sward for the first furrow at a proper distance from the coulter, acted upon by the prop a^3, and lever C^5, or their equivalents.

"2d, Is the piece D^3, fastened to the heel of the mould-board, in combination with the cutter C^4, to turn wide furrows.

"3d, Is the mode of connecting the tongue and plough, respectively, to the axle, by means of the links and the loose tenon on the tongue, substantially as described, so as to allow the team to walk entirely aside from the furrow, or direct course of the plough, in ploughing prairie, marsh, or other land, with soft under strata, and make the plough run smoothly and work well; and so as also to enable the ploughman to take an extraordinarily wide furrow, with one member of the team walking in the furrow, with a common yoke, thus dispensing with the long yoke now commonly used for that purpose.

"4th, Is the rope D, and lever D^1, or their equivalents, in combination with the mode of connecting the tongue and plough to the axle, substantially as described, for the purposes set forth in the within specification."

---

66. For an *Improvement in Centrifugal Sugar Drainers;* Daniel King, Brooklyn, New York, November 25.

Claim.—"What I claim is, centrifugal machines for separating fluid from other matter, constructed and operating as herein set forth, with detachable vessels containing the substance to be operated upon, irrespective of the exact mode of attachment, the number of vessels used, or their form."

---

67. For an *Improved Method of Operating Rudders;* Thomas H. Mortimer and James Gardiner, Charleston, South Carolina, November 25; patented in France, June 11, 1851.

"This invention consists in certain means to be employed in vessels steered by two rudders, one on each of the stern post, for the purpose of controlling the said rudders and bringing either one into operation, while the other is stationary."

Claim.—"Having thus fully described our invention, we will proceed to state what we claim as new: We claim controlling the operation of the rudders, in such a manner as to bring either into operation while the other is stationary, by means of the pins, or studs, on their tillers, in combination with the grooves or slots, in a wheel or disk, receiving motion upon an axis, or by the equivalents of the same, substantially as herein described."

---

68. For an *Improvement in the Manufacture of Door Knobs;* Orrin Newton, Pittsburgh, Pennsylvania, November 25.

Claim.—"I claim the combination and arrangement of the arms, sliding plate, springs, and lever, substantially as described, operating in the manner, or in any analogous way, for the purpose set forth."

69. For an *Improvement in Drop Presses;* Milo Peck, New Haven, Connecticut, November 25.

Claim.—"What I do claim as my invention is, the general arrangement and combination of the crank and shaft with its sweeps, moving in the same direction with the moving gear or pulley, and the ratchet wheel joined together, and running loose upon the shaft constantly in the same direction, substantially as I combine them, for the purposes herein described. I also claim the lock, in combination with its sweep and springs, and with the crank, to stop its motion not too abruptly, and to hold it until it is unlocked, by the hand or foot of the workman, substantially as described."

---

70. For an *Improvement in Cider Mills;* David F. Phillips, Republic, Ohio, November 25.

Claim.—"Having thus described the portable cider-mill, I wish it to be understood, that I make no claim to originality of invention to any part of the mill, separately considered; nor do I claim as new, any part of the arrangement of the press, grinding cylinder, or hopper. But what I do claim as new is, first, the arrangement of the parallel slicing knives, in combination with the reciprocating follower, made as described, with channels and ribs on its inclined face, when used with a grinding cylinder, and concave, made and arranged as described and represented, for first slicing the apples, and then delivering the slices, successively, to the grinding cylinder, to be reduced to pumice, in the manner herein described."

---

71. For an *Improvement in Shingle Machines;* Franklin Skinner, Dunkirk, New York, November 25.

"The nature of this invention consists in constructing a shingle riving and shaving machine, with such devices and peculiarities, that it may rive shingles of any required thickness, even from timber whose grain is crooked or irregular; and that will shave shingles on both sides at one motion, accurately preserving the longitudinal centres thereof, even when the grain of the timber is winding; and that will, moreover, shave shingles of a uniform thickness for a part of the length thereof, according to the option of the operator, and wedge-shaped, or tapering, for the rest of the length thereof."

Claim.—"What I claim as my invention, are, first, the peculiar form and mode of adjusting of the riving plate E, the same being self-adjusting, by means of the spring F, upon which it rests, and the end of the plate contiguous to the riving knife, being bent upward, (to accommodate irregularities in the grain of the shingle timber,) as herein specified.

"2d, The employment (in combination with a shingle shaving machine) of the rolls T, levers *x*, *z*, hanging rods X, spring *k*, and bent lever *p*, or their equivalents; the whole being arranged and operated in the manner and for the purpose herein described; the levers, rod and spring acting upon the rolls, and pressing them uniformly towards each other, for the purpose of unwinding or straightening the rived shingle, in the first instance, and the bent lever, (being operated by the motion of the connecting rod R, and acting upon the spring *k*,) having the effect of increasing the force or pressure of the rolls upon the shingle, (as the latter passes between them,) for the purpose of preventing the splitting of the shingle, in advance of the cutters, as they approach the thin end of the shingle, as herein set forth."

---

72. For an *Improved Valve for Oscillating Engines;* Wm. M. Smith, Georgetown, District of Columbia, November 25.

Claim.—"I do not claim the circular valve, nor the manner of reversing the engine by turning the valve. But what I claim as my invention is, the arrangement of the piston valve with a ground face, in a cylindrical steam chest, as described above, by which the necessity of packing about the trunnion and plummer block is avoided, consequently saving much friction in the trunnion."

---

73. For an *Improvement in Railroad Car Brakes;* Francis A. Stevens, Burlington, Vermont, November 25.

Claim.—"What I claim as my invention is, the combination and arrangement of the

levers, link-rods, and shoes, or rubbers, substantially as herein described, whereby each wheel of both trucks of a car is retarded with an uniform force, when the brake is put into operation."

Re-issues for November, 1851.

1. For *Improvements in the Screw Wrench;* Solyman Merrick, Springfield, Massachusetts; patented August 17, 1835; re-issued November 25, 1851.

Claim.—"What I claim as my invention is, combining with a wrench, in which the inner jaw slides on a bar permanently attached to the outer jaw, and making part of, or permanently attached to the handle, substantially as described, a screw thread and nut connecting the movable jaw with the said bar, between the said movable jaw and that part of the handle grasped by the operator, in the manner and for the purpose, substantially as described. I also claim the arrangement of the screw upon the two circular edges of the flat bar, in the manner and for the purpose herein described."

Designs for November, 1851.

1. For a *Design for Stoves;* J. W. Gibbs, Albany, New York, Assignor to North, Harrison & Chase, Philadelphia, Pennsylvania, November 11.

Claim.—"What I claim as my invention is, the ornamental design for a stove, as herein described, and as represented in the annexed drawings."

---

2. For a *Design for Iron Railings;* Frederick Fitzgerald, Assignor to Silas C. Herring and John Ryer, City of New York, November 18.

Claim.—"What I claim as my invention is, the design, arrangement, and configuration of the several ornaments composing the balustrade and step railing, branching or leading therefrom, as represented and described."

---

3. For a *Design for Parlor Stove Plates;* Apollos Richmond, Assignor to A. C. Barstow & Co., Providence, Rhode Island, November 18.

Claim.—"What I claim as my production is, the new design, consisting of the mouldings, panels, and ornamental configurations, herein above described and represented in the drawings, respectively for the top, front, and end plates of a parlor stove."

---

4. For a *Design for a Hat Stand;* Charles Muller, Tompkinsville, New York, November 18.

Claim.—"What I claim as my invention is, the design and configuration of a hat stand, representing a Triton, or similar figure, holding up the branches of a plant, in the manner aforesaid, with the basin lying in a bed of leaves or flowers, all arranged substantially as above described and set forth."

---

5. For a *Design for a Parlor Stove;* Ezra Ripley and N. S. Vedder, Assignors to Low & Hicks, Troy, New York, November 25.

Claim.—"What we claim is, the design and configuration of a parlor stove, substantially the same as herein described and represented in the annexed drawing."

DECEMBER.

1. For *Improvements in Looms for Weaving Bags;* Cyrus Baldwin, Manchester, New Hampshire, December 2; ante-dated August 30, 1851.

Claim.—"What I claim as my invention is, first, placing the cams upon one or more shafts, in such a manner that they can be moved, so as to change their relative position in regard to each other, with or around the shaft, if upon separate shafts, or around the shaft, if upon the same shaft, in combination with the devices, substantially such as

are herein described, or their equivalents, for releasing, changing, and holding said cams, as may be required, for the purposes set forth in the foregoing specification.

"2d, Is the pin v, on the spring f^1, in combination with the pawl, m, or their equivalents, to force back the rod d^3, and propel the wheel I, by the pin d^3, acting against the inclined sides of the notches h^2, h^3, so that the pin d^2 will fall back on the groove d^1, and allow the wheel I, to be propelled by the pin c^4."

---

2. For an *Improved Hand Drill;* Wm. Bushnell, City of New York, December 2.

Claim.—"What I claim as my invention is, the combination of the helical spring with the screw upon the drill shaft, and the opening and closing nut or screw nippers, the whole being applied in the manner substantially as described, and operating for the purpose of controlling all the required movements of the drill, in the line of the axis of its revolution, in giving it the pressure upon its work, controlling the said pressure, and withdrawing it from its work, as herein fully set forth."

---

3. For *Improvements in Hurdle Fences;* Cyrus C. Cole, Rushville, New York, December 2.

Claim.—"Having thus fully described my improved fence, what I claim therein is, the method of locking and supporting the same, by means of the notched sills and lock braces, as herein described."

---

4. For an *Improvement in Machines for Crimping Package Papers for Soda Powders, &c.;* Carlos A. Cook, Lowell, Massachusetts, December 2.

Claim.—"What I claim as my invention is, the combination and arrangement of the surfaces, t, u, r, w, x, p, b, a, c, d, in the manner substantially as represented in the drawings, and for the purpose of folding the paper in a trough-like shape, and in other respects convenient for being filled with powder, and folded together."

---

5. For an *Improvement in Railroad Switches;* William N. Raines, Thomson, Georgia, December 2.

Claim.—"Having thus described my invention and improvement, and pointed out the difference between the same and other railroad switches, what I claim therein as new is, 1st, the combination of the stationary single casting c, with the single casting or switch g, each having a guard on the inside thereof, whereby the said permanent single stationary casting c, is made to subserve the purpose of the ordinary frog and auxiliary switch, in connexion with the turn-out side of the main track, as described.

"2d, I also claim, providing the movable casting g, on the inside thereof, with a guard m, for the purpose of guiding the train of cars over the switch, in a straight line, when running in the direction of the arrow y^3, and thus prevent the cars from passing on to the turn-out rails, when the switch is in the position shown in fig. 2; the projection, or frog f, being of sufficient length, in connexion with guard m, to guide the train on to the main rail a, as described."

---

6. For an *Apparatus for Propelling and Steering;* John C. fr. Salomon, Cincinnati, Ohio, December 2.

"The nature of my invention consists in forming water-ways in the rudder, and appending thereto a submerged water wheel and propelling wheel, or wheels, to be worked by a force of water through said water-ways."

Claim.—"I do not claim the peculiar wheel here used, as a water wheel and propeller; but what I claim as my invention is, the combination of the water-ways in the rudder, with a water wheel and submerged propeller, to be operated by hydraulic pressure, for propelling and steering vessels, substantially as herein set forth."

---

7. For an *Improved Lock for Safes, &c.;* F. C. Goffin, Assignor to Charles J. Gaylar, City of New York, December 2.

"My invention consists in arranging and combining a 'talon' with a series of tumblers,

said talon having a stud upon it, and so arranged that when the stud is within a curved slot in the tumblers, the key may act upon the talon and bolt; but when the stud is thrown out of the curved slot, and above the outer surfaces of the tumblers, the key cannot act upon the bolt; the stud therefore must be brought within the curved slots, before the bolt can be withdrawn or acted upon by the key: this arrangement effectually prevents the lock from being picked."

Claim.—"I do not claim the knobs D, D, and collars E, E, with the numbers on them, for the purpose of serving as indexes, as they have been previously used; neither do I claim a series of tumblers, as those described, for these have also been previously used. But what I do claim as new is, the 'talon' N, with the stud *q*, attached to it, in combination with a series of tumblers O, having curved slots *o*, in them; said talon and tumblers operating as described, viz: the talon being thrown up by the key, during the second revolution, and the stud *q*, in consequence, placed on the other side of the tumblers, the talon being held up by the catch P, the catch *y*, on the talon, bearing against the stump *z*, and preventing the bolt from being moved back or withdrawn; the talon N, requiring to be let down when the bolt is to be withdrawn, so that the stud *q*, may work or slide in the curved slot *o*, in the tumblers, and catch *y*, be free from the stump *z*, the bit of the key, in turning, acting upon the end of the talon and shooting back the bolt, substantially as described."

---

8. For *Improvements in Railroad Car Trucks;* Benjamin Hinkley, Troy, New York, December 2.

Claim.—"Having thus fully described my invention, what I claim therein as new is, hanging the frame of a six-wheel truck immediately on the centres of the front and rear axles by a shank and socket, and to the centre axle by guides, in combination with horizontal diagonal or other bracing, connecting and operating said wheels, so that they may adjust themselves to any lateral curvature in the track, and at the same time allow either of the sets of wheels to pass over any obstruction, without raising the other sets from the track; and for the purpose, also, of allowing the set from which the weight is removed, to still retain its position on the track, for guiding the others, as herein fully set forth and described."

---

9. For an *Improvement in Steam Carriages for Railways;* Joseph H. Moore and William P. Parrott, Boston, Massachusetts, December 2.

Claim.—"Now we wish it distinctly understood, that we do not claim the combination of a steam engine with the axles or body of a carriage; nor do we claim any arrangement of it, by which it is directly applied to a 'fixed' axle, or one so connected directly with the carriage body, that other than a rotary motion, it can have no horizontal and rocking movements independently of the same. But what we do claim as our invention or improvement is, the arrangement or arranging the steam engine directly on a *movable* truck frame of a 'long car' or carriage, in combination with arranging the boiler, or steam generator, on or in the carriage body or frame, and connecting the engine and steam generator by a flexible pipe, or pipe having a ball and socket, or other equivalent connexion or joint, such as will allow of all the necessary rotary and rocking movements of the truck frame and carriage body; the whole being substantially as herein before described."

---

10. For an *Improvement in Expanding Mandrels;* Walter Sherrod, Providence, Rhode Island, December 2.

"The nature of my invention consists in the use of an arbor, having a taper screw cut upon it, on which is fitted an expanding shell, or nut, formed of segments or pieces, whose length lie longitudinally with the arbor, and which are held together by coiled springs encircling them."

Claim.—"What I claim as my invention is, 1st, the use of an expanding nut or shell, formed in segments, whose interior faces have portions of a screw thread cut thereon, which fit within and correspond with the thread of a taper screw of the mandrel.

"2d, The manner of holding together, or retaining in their places, the several segments of the expanding shell or nut, by means of a coiled spring or springs, encircling the segments, and made of sufficient length to admit of the nut expanding, without destroying the confinement or hold of the segments, as described."

11. For *Improvements in Machines for Stretching and Drying Cloth;* Thomas Barrows, Dedham, Massachusetts, December 2.

Claim.—"What I claim as my invention is, the combination of the two winding and lengthwise stretching contrivances, or stretchers, the two widthwise rotary stretchers, and the three or any other suitable number of drying cylinders, substantially as described, so as to enable a person to cause a piece of cloth to pass in one direction over and around the drying cylinders, and next in the opposite direction, as many times as may be desirable, in order to stretch, dry, and finish the same, to the extent that may be required."

---

12. For an *Improvement in the Mode of Papering Pins;* Chauncey O. Crosby, New Haven, Connecticut, December 2.

Claim.—"I do not claim the crimps that the pins are inserted through; neither do I claim rolling up the paper of pins from both ends to the centre, that being old and well known. But what I do claim as my invention is, the new mode of papering pins, substantially as herein described. I claim the new manufacture of 'book pins,' formed by folding the paper in parallel folds at regular distances from each other, producing fan-like or zigzag folds, which allows the paper of pins to be closed into compact form, without rolling or winding, for the purposes herein set forth."

---

13. For an *Improvement in Machines for Working Clay;* Daniel and George Duchemin, Cincinnati, Ohio, December 2.

Claim.—"What we claim as our invention is, 1st, the fixed double eccentric cams, I, I, in combination with the pitmans J, J^1, attached to the slides K, K^1, and by means of L, L^1, giving motion to the pawls M, M^1, and through them to the rack Q, and the wheel E, for the purposes herein set forth and described.

"2d, We claim the particular arrangement and combination of machinery set forth and described in figs. 2, 3, and 4, in combination with the tempering wheel E, fig. 1, especially the double eccentric I, I, and the pitmans or connecting rods J, and J^1, the slides K, and K^1, with the pawls M, M^1, the connecting bar O, the shifting rod P, and the rack Q, as applied to tempering clay, for making brick, or any other purpose, or any equivalent device or arrangement of machinery, for accomplishing the same purpose, substantially in the same manner."

---

14. For an *Improvement in Tailors' Measures;* James Maginnis, Lockport, New York, December 2.

Claim.—"What I claim as my invention is, the gauge designated by the letters A and S, in the drawings; this gauge has two arms slit through the centre, from the cross bar down, as illustrated by fig. 1, in the drawings; the front arm extends up and forms a semi-circle over and around the top of the inner arm; this semi-circle is slit through the centre, and forms a way for the two shoulder straps, which are attached by a pivot to the top of the inner arm to turn on, with screws to set them to the desired place; the semicircle is designated by the letter D, in the drawings; this gauge moves horizontally on strap E, from the front backward, or vice versa, until it strikes the front of the arm hole, and locates the same, and is set by screws to the desired place; again, this gauge can be drawn perpendicularly, so as to increase the length of the shoulder, for a very full breasted man, or contracted so as to fit a hollow breasted man."

---

15. For an *Improvement in Winding Watches;* Theodore Noel, Memphis, Tennessee, December 2.

Claim.—"What I claim as my invention is, the application to watches, of the machine keys, substantially as herein described and illustrated by the accompanying drawings, which keys and their boxes are enclosed by the watch case and form a part of the watch, rendering the use of the ordinary watch key unnecessary, without the expense and great friction of the complicated machinery heretofore used for the same object."

16. For an *Improvement in Carriage Perch;* Lewis E. Stilwell, Franklinville, New York, December 2.

C aim.—"What I claim as my invention is, constructing the front extremity of the perch so as to form a spindle, which passes through a tube on the turning plate, to connect it with the front axle-tree, and at the same time to form a hinge, on which the front axle-tree can rock, the latter being a new duty additional to that which the forward extremity of the perch has heretofore performed; thus increasing the efficiency, without increasing the complexity or cost of the coupling."

---

17. For an *Improvement in Machines for Boring Holes in Posts;* Thomas T. Strode, Coatesville, Pennsylvania, December 2.

Claim.—"Having thus described my improvements on the machine for boring holes in posts for fencing, what I claim therein as new is, combining the pivoted bar R, provided with a catch and inclined plate S T, and long arm V, and stop or pin *p*, with the gauge bar U, provided with rows of pins *g*, and mounted in bearings in the inclined carriage G, whereby the movement of the latter is regulated in moving the timber laterally in boring a series of holes as described in the specification.

"I also claim the combination of the pivoted beam P, inclined plane *b*, inverse half nut screw *f*, and propelling screw shaft M, whereby the carriages are made to advance toward the boring tool, and is disengaged, for the purpose and in the manner described and represented.

"I do not, however, intend to confine my claim to the precise construction described in the foregoing specification, but to use such a form of construction as may be the best adapted to accomplish the desired object by means substantially the same. Neither do I claim any portion of the machine above described, that has been practised successfully by others, prior to its being invented by myself."

---

18. For an *Improved Foundry Apparatus;* Chapman Warner, Louisville, Kentucky, patented in England, October 1849; December 2.

Claim.—"Having thus described my improvements in the art of founding, what I claim therein as new is, 1st, The method of making moulds for castings, by impressing the pattern into a measured quantity of sand contained in a flask, constructed with steps or protuberances and depressions, substantially as herein described, so that the mould, when finished, may be surrounded by sand varying in thickness, in proportion to the different degrees of compression which it receives by the impression of the pattern, in order that the density or hardness of the face of the mould may be rendered more uniform, substantially as herein set forth.

"2d, I claim the method of charging the half flask with the requisite quantity of sand, to form a half mould, by surmounting said flask with a hopper, and passing the two to and fro beneath a sand box, substantially as herein described.

"3d, I claim the method of detaching the hopper from the flask after the mould is formed, and of applying it thereto before the sand is introduced, substantially as herein described.

"4th, I claim the method of applying facing sand to the flask, prior to the formation of the mould, by means of apparatus, substantially as herein described.

"5th, I claim the method of tempering, distributing, and sifting moulding sand by means of machinery operating substantially as herein described.

"6th, I claim the core spindle, constructed substantially as herein described.

"7th, I claim the method of filling a series of flasks with melted metal by a single sprue by means of a sprue case, with which the flasks are connected, substantially as herein set forth.

"8th, I claim the combination of apparatus for tempering the moulding sand apparatus for distributing the tempered sand, and sifting it into the sand reservoir, and apparatus for supplying to the flask a measured quantity of sand from the reservoir, with a flask and pressing apparatus, whereby the sand is worked and the mould produced by machinery operating substantially as herein set forth."

---

19. For an *Improvement in Running Gear of Locomotives;* Ross Winans, Baltimore, Maryland, December 2.

Claim.—"What I claim as my invention is, the use of steel springs for the support of

the weight carried by the driving wheels of a locomotive engine, in combination with bearing or supporting wheels, placed both before and behind the aforesaid driving wheels, which bearing wheels support a portion of the weight of the engine, through the medium of steel, air, india rubber, or other springs, possessing the properties herein described as belonging to steel springs as distinguished from steam springs, for the purpose set forth in the specification.

"I also claim the employment of steam springs or steam pressure operating separately from the propelling cylinders, for the purpose of varying the pressure of the driving wheels of a locomotive engine upon the rail of the road, in combination with bearing or supporting wheels placed both before and behind the aforesaid driving wheels, which bearing wheels support a portion of the weight of the engine, through the medium of steel, air, india rubber, or other springs, possessing the properties herein described, belonging to steel springs, as distinguished from steam springs, for the purpose set forth in the specification."

---

20. For an *Improvement in Apparatus for Opening and Closing Gates;* Enoch Woolman, Damascoville, Ohio, December 2.

Claim.—"Having thus described my improved gate, what I claim therein as my invention is, making a blank space on the lever *o*, and vibrating it so far as to disengage the cogs upon it from the cogs upon the plate *l*, so that the gate may be opened and closed by persons on foot without the aid and without operating the lever *o*, in combination with the connecting of the bar *d*, or latch, to the lever *o*, by the rope *g*, so as to unlatch the gate, when the lever *o*, vibrates before the cogs on the lever *o*, gear into the cogs upon the plate *l*, to open the gate, substantially as described."

MECHANICS, PHYSICS, AND CHEMISTRY.

Experiments on the Conducting Powers of Wires for Voltaic Electricity. *By* C. L. Dresser, *Esq.**

The instrument used in these experiments was the glass thread galvanometer of Ritchie, described in the Philosophical Transactions.† This instrument, though one of the most perfect kind, easy of construction, well adapted for the measurement of electro-magnetic forces, and extremely accurate, has not received that attention from scientific men to which the facility of its use entitles it. Requiring no calculation, a vast number of experiments may be read off in rapid succession.

A few alterations were made in its construction.

1. The graduated card placed under the needles was discarded as being no measure of the forces exerted, and a plain card with a black mark under the centre of influence of the conducting wires substituted. To this mark the needles were carefully adjusted at every experiment.

2. The graduated card at the top was enlarged to five inches diameter, and carefully graduated to degrees; and by an index traversing this card, the degrees of torsion necessary to bring the deflected needle vertical to the black mark on the lower card was read off easily to a fraction of a degree.

3. The graduated plate turned on its own axis, independently of the axis of the glass thread, rendering the adjustment of the needles easy and perfect.

4. The needles were considerably increased in size, and highly magnetized.

With these alterations, the action of the galvanometer was certain

* From the London, Edinburgh, and Dublin Philos. Magazine, September, 1851.
† Philosophical Transactions, 1850, p. 218.

and delicate, returning after even a deflexion of a thousand degrees, or three times round the card, with certainty to the index mark on the lower card; and the same experiment repeated corresponding to the fraction of a degree.

The battery used was my gas-carbon battery, and the following means were adopted to keep it constant:

1. The nitric acid cell was filled with the acid of commerce, but the zinc cell only half filled with dilute sulphuric acid.

2. The prism of carbon was suspended at its top to a rack-work, by which its immersion to a greater or less depth was regulated; consequently, any required amount of electricity obtained.

With these precautions, a constant current of electricity was maintained for hours; rarely varying, after effecting a torsion of three or four hundred degrees, one degree for hours. By this means also, at all times the same amount of current could be obtained, rendering it easy to recommence the experiments.

TABLE I.—*Battery power* 400. *Each wire was No.* 20.

Feet.	Copper wire.	Differences.	Feet.	Iron wire.	Differences.
1	398		1	330	
2	380	18	2	280	50
3	365	15	3	240	40
4	352	13	4	210	30
5	340	12	5	190	20
6	330	10	6	172	18
7	320	10	7	158	14
9	296	24	9	135	22
10	286	10	10	128	7
12	269	17	12	112	12
14	254	15	14	100	12
16	240	14	16	92	8
18	230	10	18	85	7
20	220	10	20	78	7
			22	73	5
			24	68	5
			26	64	4
			28	60	4

From the above table of experiments, it is evident that the often quoted law of the conducting power of wire being inversely as the length does not obtain in short lengths. But there is an evident intimation of some other law, and probably different for different metals.

Broke glass thread. New thread gives 300, without altering battery power.

TABLE II.—*One cell. No.* 16 *wire.*

Feet.	Copper.	Differences.	Iron.	Differences.
1	282		256	
2	275	7	235	21
3	268	7	217	18
4	262	6	200	17
5	256	6	187	13
6	148	5	175	12
7	138	5	164	9
8	133	5	157	7

From this table, compared with Table I., it does not appear that with a thicker wire there is any nearer approach to the old law, but also that some other law obtains.

TABLE III.—*No.* 16 *Wire. Battery power* 400. *Intensity two cells.*

Feet.	Copper.	Differences.	Iron.	Differences.
1	400		355	
2	391	9	320	33
3	382	9	294	26
4	476	6	270	24
5	370	6	252	18

Increase of intensity does not appear to approach near to the supposed law.

TABLE IV.—*Wire measured with a micrometer in hundredths of an inch. Battery power* 207. *One foot of wire. Diameter of galvanometer wire* ·740 *of an inch.*

Measure.	Copper: Current conducted,	Measure.	Iron: Current conducted.
370	190	360	129
480	195	510	65
700	206½	640	182
740	207	720	188

The wires of iron and copper on parallel lines were said to be of the same gauge, but the micrometer showed them to be of very different diameters. This table does not coincide with the law of the conduction of wires of different diameters being as the squares of their diameters.

Power of hydrogen to abstract the heat produced by the passage of electricity.

Battery power 410. Current through steel wire 175 hundredths of an inch.

Quantity conducted.

200 . . . . wire red-hot in air.

310 . . . . in hydrogen, and invisible in the dark.

In this experiment, battery power not observed.

Same wire as above.

In air red-hot 220

In current of air, quite cold 270

It would appear that the heating power of a current of electricity diminishes the power of conduction; also that hydrogen, by absorbing the heat, has the same effect as a current of cold air.

TABLE V.—*No.* 20 *wire placed in the air-bulb of sulphuric acid thermometer.*

Battery power.	Differences.	Current conducted.	Differences.	Degrees of heat.	Differences.
67		58		26	
92	25	73	15	44	18
107	15	84	11	75	31
124	17	91	7	90	15
145	21	100	9	124	34
170	25	102	2	143	19
202	32	108	6	160	17

These experiments, very tedious and difficult to conduct, do not appear to indicate any particular law.

Much in this department of electricity appears yet to be done, before we are able to define the laws of conduction, and there are many difficulties to be encountered. It is almost impossible to get wire of any length, of equal thickness and texture. It is also not easy always to obtain the same connexions, and the least variation in this respect vitiates the experiments. Some of the anomalies in the tables are to be traced to these causes.

A difference of temperature also, it appears, will affect conduction. Even bending the wire with so delicate an instrument as the torsion galvanometer, will affect the experiment; and twisting will alter its powers permanently.

On a New Blowing Engine, working at High Velocities. By Mr. Archibald Slate.*

At a former meeting, the writer laid before the Institution the opinions which he entertained on the subject of blowing cylinders, proposed to be driven at high velocities, concluding that there would result thereby a large economy in the manufacture of iron throughout the entire plant and appliances of this indispensable machine. (See *Artizan*, 1850, p. 203.)

It was observed in the former paper that, since the application of the double-acting movement, introduced some fifteen years ago, the blowing cylinder has remained, up to the present time, without a single other essential improvement. As left at that period, it continues a large and cumbrous machine, with complicated and slow motion; insomuch that the light and elastic body of the atmosphere is driven through at no higher velocity than the more ponderous body, water, can be passed through an ordinary pump. While the motive power was derived, in most instances, from a waterfall, there might indeed be alleged some semblance of a reason for the slow motion that has been spoken of; although, even in such circumstances, it is but little conceivable how the intervention of machinery, to quicken the passage of the lighter and elastic medium, should so long have remained a desideratum. But the question becomes infinitely more inexplicable, since the motive power employed has in almost every instance been steam, itself a medium in the highest degree light and elastic; capable, at the same time, of being worked under a pressure, and at a velocity, far beyond anything required at present, or that probably ever will be required of the air from a blowing cylinder.

Such being the facts, and contemplating the power and speed attained on the railway by locomotive engines, the writer was led to reflect that a similar power was at least capable of being applied to the blowing cylinder; and, while impressed with this train of thought, he had occasion, in the latter part of the year 1848, to make use of some small 9-inch cylinders, driven by air from a large blowing engine. It was then remarked, that these small engines, when driving shafts only, sometimes attained a velocity of 200 revolutions per minute, under the ordinary

* From the London Artizan for October, 1851.

blast pressure; when the idea suggested itself, that it might be possible to reverse their motions, making them blowing cylinders in place of air engines; and this idea, on being tested, turned out to be correct.

The cylinder experimented on was of nine inches diameter, and one foot stroke, and being driven at the rate of 320 revolutions per minute, discharged the air at 3½ lbs. per square inch, through a tuyere of 1⅛th inch, being exactly $\frac{1}{64}$th part of the area of the blowing piston. This performance exceeds, as is well known, by double its amount, that of any ordinary engine; the total area of the tuyeres, with a 90-inch blowing cylinder, at a pressure of 3½ lbs., being about fifty circular inches, which is only $\frac{1}{161}$ part of the area of the blowing cylinder.

Assured by the complete success of this experiment, the writer proposed to construct a steam and a blowing cylinder of two feet stroke; the cylinder for steam to be of ten inches diameter, and that for blast of thirty inches; and to couple them, if necessary, with a second and similar set, acting at right angles upon a common axle; and he is still of opinion that such would probably prove the best arrangement, as well as the best proportions to observe in construction.

But in the actual experiment, the cylinders proposed to be placed at right angles have not yet been constructed. The size of that used, owing to peculiar circumstances, has been considerably enlarged. In 1850, finding that more air was required for the manufacturing purposes to which it was applied, the writer, and Mr. Cochrane, his partner, resolved to make a blowing cylinder of such a size as would practically test the question of high velocities; and a steam engine, having a cylinder of fourteen inches diameter, being ready at hand, was fitted with a 40-inch blowing cylinder, and to this engine the further remarks have reference. The stroke is two feet; the total weight of the engine about six tons; the boiler made use of weighed three tons, thirteen cwt.; its length over all is twenty-seven feet, having egg ends; its diameter four feet.

The first set of experiments were made in presence of Mr. Beyer, Mr. M'Connell, Mr. Daniel Gooch, Mr. Geach, Mr. Evers, Mr. Cochrane, and several other gentlemen who took an interest in the proceedings, which were of the following nature.

On the outlet pipe were placed four tuyeres: two of them 2½ inches diameter, and the remaining two 2 inches diameter, all blowing into the open air. The engine being run up to its full velocity, reached 145 strokes per minute. At this rate, the density of the air issuing from the four tuyeres approached nearly to five lbs. per inch, the engine remaining perfectly noiseless and steady, and the blast being so continuous and regular, that the mercury in the barometer did not vary more than one-eighth of an inch—in fact, continued barely living in the tube.

A variety of minor experiments followed, not necessary to be dwelt upon at present; but it is believed perfectly warrantable to state, as the result, that each person present felt convinced that he had seen exhibited a blowing machine of at once a powerful, cheap, and efficacious character.

Although the experiments thus detailed were of the most satisfactory description, and indeed had exceeded every expectation of a first performance, the writer nevertheless felt convinced, from observation of the working, that the steam might be considerably economized; and before

proceeding to apply it to actual use, resolved to fit the engine with an adjusting expansive valve, by which such economy might be realized. When this had been fitted, and the requisite attachments made, its full complement of blast was thrown into one furnace, viz.: 3500 cubic feet of air per minute; the pressure of the air in the main, close upon the engine, was a little in excess of three lbs. to the inch; at the tuyeres on the furnace, it was, if anything, rather under three lbs.: but this slight discrepancy probably took its origin from the tortuous character and length of the main, which exceed 300 feet; a circumstance which it was found impossible to avoid, without leaving out of consideration the objects to which the new blowing power is ultimately to be applied.

The engine, during the trial, varied from 96 to 100 strokes per minute. The steam from the one small boiler, 27 feet by 4, remained full and sufficient for this work, after the engine had worked every day for nearly a month, and had been seen by Mr. Benjamin Gibbons, and several other persons connected with the iron trade. An opportunity again occurred of trying it upon one furnace, with the same result as above; this last experiment was made in the presence of Mr. Samuel Blackwell. With regard to fuel, on a subsequent trial, while working in connexion with a larger blowing engine of the ordinary sort, delivering into the mains 3000 cubic feet of air, at a density of 3¼ lbs. to the inch, it was found to amount, by measurement, to two tons five cwt. of small refuse coal or slack, in twelve hours.

Although the writer does not present the arrangement of the engine, here given, as a perfect machine, he can entertain no doubt that the development of the principle must greatly stimulate the production of iron. It will be perceived how, by the use of blowing machines, working at high velocities, the expense of plant and machinery for blowing a furnace may be reduced, at the rate of sixty-five per cent., from what it stands at present; or, to one-third of the present amount. The above-mentioned experiments at Woodside have proved such engines to be adequate to as large a class of works as exist in Staffordshire. Their simplicity and portable character make them equally available at the smallest charcoal furnaces, in however remote a quarter there might be occasion for their use.

Mr. Middleton inquired, whether the blast from the small engine went direct to the furnace, or through a reservoir?

Mr. Slate said, they had a receiver, twelve by four feet; but in the experiment with one furnace, when the other was in repair, they let it blow through the whole of the large air main.

Mr. Middleton said, that he remembered the late Mr. Murdock worked a similar blowing engine at Soho, twenty-five years ago; it was direct acting, and the only difference was that it had a D valve, and worked at a slower velocity than Mr. Slate's engine.

The Chairman said, he had a similar blowing engine in regular work at Wolverton, only working vertically instead of horizontally; but his engine only made from fifty to sixty strokes per minute, while that now under description performed one hundred and thirty in the same time. This gave the blowing engine of Mr. Slate a great advantage, and was its distinctive feature; the great gain was in the high speed employed.

Mr. Davies observed, that Mr. Slate's engine could give a steady blast for a furnace, with full pressure, which Mr. Murdock's engine could not do.

Mr. Slate remarked, that though Mr. Murdock's engine had been at work at Soho for the period stated, no further progress had been made in the construction of the blast engine; for at Soho they still continued to make only the old ponderous engines.

Mr. Middleton said, it had been applied at the smithy at Woolwich, and had been at work there for many years. He thought, though Mr. Slate's engine was different in some respects, it was similar in principle to Mr. Murdock's.

Mr. W. Smith was quite satisfied that Mr. Slate's engine would maintain a constant blast for a furnace. He had seen Mr. Murdock's engine at work; it was an open-top cylinder, and was quite another kind of engine. He thought that Mr. Slate's plan of blowing engines was an important advantage in the saving of expense in the erection of iron works, and he believed that a blowing engine could now be erected for £500 on that plan, as well as one on the old plan for £1500, to do the same work.

The Chairman thought that Mr. Slate's engine was certainly deserving of approbation, and he hoped that he would continue his investigation of the subject, as any improvement or economy in the manufacture of iron was of great importance.

On the Use of Electro-magnets made of Iron Wire for the Electro-magnetic Engine. By J. P. Joule, Esq. *Communicated in a Letter to the late* Mr. Sturgeon.*

Dear Sir: In my last letter I gave you an account of some experiments which were intended to prove that electro-magnets made of iron wire are the most suitable for the electro-magnetic engine. In those experiments round wire was used; and it was my opinion that the wire magnets were put in a disadvantageous position, in consequence of the interstices between the wires. I have since confirmed my views on this subject by the following experiment:—

I constructed two magnets. The first consisted of sixteen pieces of square iron wire, each $\frac{1}{11}$th of an inch square and 7 inches long, bound very tightly together so as to form a solid mass, whose transverse section was $\frac{4}{11}$ths of an inch square; it was enveloped by a ribbon of cotton, and wound with sixteen feet of covered copper wire, of $\frac{1}{16}$th inch diameter. The second was made of solid iron, but was in every other respect precisely like the first. These magnets were fitted to the apparatus used in my former experiments, and care was taken to make the friction of the pivots equal in each. The mean of several experiments gave 162 revolutions per minute with the first, and 130 with the second magnet.

In the further prosecution of my inquiries, I took six pieces of round iron of different diameters and lengths, and also a piece of hollow round iron, half an inch in diameter, and $\frac{1}{12}$th of an inch thick in metal; these were bent into the U-form, so that the *shortest distance* between the poles of

* *Annals of Electricity, vol. iv. p.* 58.

each was half an inch; each was then wound (with the usual precautions to ensure insulation) with ten feet of covered copper wire of $\frac{1}{10}$th inch diameter. The lengths and diameters are given in the following table. No. 1 is the hollow magnet. The attraction was ascertained by suspending a straight steel magnet, $1\frac{1}{2}$ inch in length, horizontally to the beam of a balance, and bringing the several electro-magnets directly underneath at the distance of half an inch, which was preserved by the interposition of a piece of wood half an inch thick. Care was taken that the battery remained constant during the experiments.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Length in inches, . .	6	$5\frac{1}{2}$	$2\frac{2}{3}$	$5\frac{1}{4}$	$2\frac{1}{2}$	$5\frac{1}{4}$	$2\frac{1}{2}$
Diameter in inches, . .	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{4}$
Weight lifted in ounces, .	36	52	92	36	52	20	28
Attraction for steel magnet in grains,	7·5	6·3	5·1	5·0	4·1	4·8	3·6

A steel magnet of such dimensions as enabled me to compare it fairly with the electro-magnets, was found to exert an attraction of 23 grains for the small steel magnet, though its lifting power was only 60 oz.

These results will not appear surprising if we consider, first, the resistance which iron presents to the induction of magnetism; and secondly, how very much the power of iron to conduct magnetism is exalted merely by the completion of the ferruginous circuit. In order, however, to explain why the long electro-magnets have a *greater* attracting power at a distance, though they lift *less* weight, than the short magnets of the same diameter, it will be necessary to observe that it was impossible to wrap the whole ten feet of wire on the smaller magnets, without disposing it in two or three layers (according to the size of the magnets.) This was a great disadvantage; and one might have anticipated in consequence, that the power of the long magnets would be greater than that of the short ones for lifting, as well as distant attraction, which is contrary to the results of the table; this may however be explained, if we admit that the comparative resistance of the iron of the electro-magnet increases to a very great amount, when its magnetism is so greatly excited as by the contact of the armature.

Nothing can be more striking than the difference between the ratios of lifting to distant attractive power, in the different magnets; whilst the steel magnet attracts with a force of 23 grains and lifts 60 oz., No. 3 attracts 5·1-grains and lifts 92 oz.

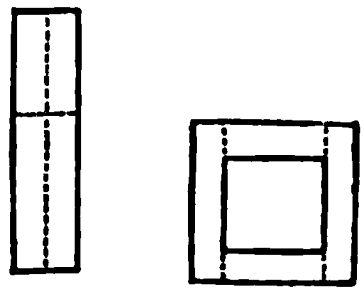
The following are some general directions for making electro-magnets for lifting:—1st, The magnet, if of considerable bulk, should be compound, and the iron used of good quality and well annealed. 2d, The bulk of the iron should bear a much greater ratio to its length than is generally the case. 3d, The poles should be ground quite true, and fit flatly and accurately to the armature. And 4th, The armature should be equal in thickness to the iron of the magnet.

I shall now proceed to consider with greater care what form of electro-magnet is best for distant attraction, as that is the only force of any use in the electro-magnetic engine. Here two things must be considered; the length of the iron, and its sectional area.

Now with regard to the length of the iron, I have found that its in-

crease is always accompanied with disadvantage; unless the wire is (by using a shorter length) forced to too great a distance from the iron. In making magnets for an engine, it will be proper to use a length less than that which gives the maximum of attraction, on several accounts.

The next thing to be considered is the sectional area. You have shown* that, on placing a hollow and solid cylinder of iron successively within the same electro-magnetic coil, the hollow piece exerted the greatest influence on the needle. I wished to ascertain whether a hollow magnet could be represented by a solid one, of which the sectional area and circumference are the same, and the thickness of which is twice that of the hollow magnet. The accompanying figures represent sections of hollow and solid rectangular magnets; and it will be seen, that if either of them is divided at the dotted lines, the separate pieces, when put properly together, will make up the other. Two electro-magnets were constructed, each 7 inches long, and wound with twenty-two feet of insulated copper wire; the sections were similar to, but twice the size of the figures. Their attractions at half an inch distance for the contrary pole of a straight steel magnet were as follows:—



	Hollow magnet.	Solid magnet.
Attraction in grains, . .	1·9	1·7
Do. with a more powerful battery, .	4·5	4·0.

The above results show that the hollow magnet has the greater attractive force; but I do not think that the difference between the two is so great as to counterbalance the practical advantages which solid bars would give if used in the engine. I shall now therefore attempt to determine the sectional area of solid iron most proper for various galvanic powers.

I made five straight electro-magnets of square iron wire $\frac{1}{11}$th of an inch thick; each was 7 inches long, and wound with twenty-two feet of insulated copper wire of $\frac{1}{18}$th of an inch diameter. No. 1 consisted of nine, No. 2 of sixteen, No. 3 of twenty-five, No. 4 of thirty-six, and No. 5 of forty-nine square iron wires, arranged in the form of square prisms. Five other electro-magnets were made of square iron rod, but in every other respect were exactly similar to the first. The following are the attractions (at half an inch distance) for a straight steel magnet, with three different voltaic forces:

		No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
1st experiment.	Attraction of iron bar magnet in grains,	1.5	1·9	1·6	2·1	2·0
	Ditto of wire magnet,	2·1	2·1	1·7	2·0	1·9
2d experiment.	Iron bar magnet,	2·0	2·5	2·35	2·45	2·2
	Wire magnet,	2·6	2·8	2·1	2·2	2·05
3d experiment.	Iron bar magnet,	2·7	3·6	3·4	3·2	3·1
	Wire magnet,	3·3	3·8	3·0	2·9	2·65

The square iron wire of which the wire magnets were constructed, was taken at the same degree of temper that it possessed when it came

* Annals of Electricity, vol. i, p. 470.

from the manufacturer. It was in consequence not so well annealed as the iron bars. On this account the numbers opposite the wire magnets are less than they would have been with better annealed wire: still the results of the table seem anomalous; for it will be remarked, that whilst the wire magnets are the most powerful of the smaller electro-magnets, the bar magnets are most powerful of the larger ones.

* * * * * * *

Action of the Sea-Worm on Timber, and the Best Means of Protection. By SAMUEL CLEGG, JUN.*

Timber exposed in marine works is subject to be destroyed by the *teredo navalis*, and *limnoria terebrans.* The *teredo*, by means of auger-like shells with which its head is furnished, bores into the timber, and forms long circular holes, lining them with a shelly substance. These worms are very numerous, and the timber attacked by them soon assumes the form of a honeycomb. They appear to penetrate all kinds of timber; that which it seems to destroy with the greatest ease is fir, in which it works more speedily and successfully than in any other, and perhaps grows to the greatest size. In a fir-pile taken from the old pier-head at Southend, a worm was found 2 feet long and ¾-inch in diameter, and they have been heard of 3 feet and 4 feet in length, and 1 inch in diameter. In hard wood they do not grow so large. Wood which has been perforated presents to casual observation no symptom of destruction on the surface, nor are the animals themselves visible until the outer part of the wood has been broken away, when their shelly habitations come in sight, and show the perfect honeycomb they have formed. On a close examination of the wood, however, a multitude of very minute perforations are discovered in the surface, generally covered with a slimy matter; and on opening the wood at one of these, and tracing it, the tail of the animal is immediately found, and after various windings and turnings the head is discovered, which in some cases is as much as 3 feet from the point of entrance. Sometimes it will happen, especially if the wood has been much eaten, that their shelly tubes are partly visible on the surface, but this is rare. They enter at the surface, and bore in every direction, both with and against the grain of the wood, growing in size as they proceed.

The *limnoria terebrans* is a minute crustacean, similar in appearance to a woodlouse, and confines its destructive operations to the surface of the wood, so that what is left undestroyed by the teredo is completed by the limnoria. On the surface of a piece of wood, only 12 inches square, Mr. Paton estimated no less than 54,000 different perforations, caused by this little creature penetrating to about an inch from the surface.†

The teredo enters the timber at various heights of the tide, sometimes confining their operations between low water mark of neap tides and the bottom of the river, occasionally piercing below the ground; and at others, attacking the wood 8 or 10 feet above low water, to 2 feet below the bed of the sea. They, however, appear gradually to relax in their destructive

* From the London Architect for October, 1851.

† They are said not to attack teak, but this is doubtful.

habits from low water towards high water. The limnoria attacks the timber higher up than the teredo, and have been found at 2 feet below high water mark.

At Southampton, piles 14 inches square have been eaten down to 4 inches in four years. At Southend old pier, the teredo showed itself in six months after the completion of the work; and in four years many of the piles, from 12 to 14 inches square, were eaten through. A pair of dock gates at Hartlepool were destroyed in eight years. At Sheerness, after a time, it was no uncommon thing to see several piles, apparently sound, floated away at each tide; indeed, they were so thoroughly perforated by the teredo, that in still weather, by putting the ear to the side of the pile, the worms could be heard at their boring labors.

Cold-blooded animals are not affected by poisons; for instance, a frog cannot be killed with prussic acid. The teredo is an animal of a much lower order than the frog, therefore it might be inferred that the impregnation of timber with creosote, or other poisonous matter, will not protect it from their ravages; but, from observation, it appears that creosote does protect the wood, to some extent at all events. A piece of unprepared timber, 800 feet from the beach at Lowestoft, was taken from a guide pile which had been left after the work was completed; it was sawn off below low water mark of neap tides, and it was evident that whilst the limnoria was attacking the surface, the teredo was destroying the interior; at the same depth, and close adjoining to the guide pile, a piece of creosoted permanent pile was sawn off, which was perfectly sound.

A most searching examination, occupying many days, was made upon every pile in Lowestoft harbor, by the direction of Mr. Bidder. There was no instance of an uncreosoted pile being sound—they were all attacked, both by the limnoria and the teredo to a very great extent, and the piles in some instances were eaten through. All the creosoted piles were quite sound, being neither touched by the teredo or the limnoria, though covered with vegetation, which generally attracts the teredo. Some creosoted timber put into Teignmouth harbor by Mr. Brunel, was found untouched by the worm after seven years; whereas all the unprepared timber was more or less affected. It may be, that the creosote being nauseous prevents the worm from attacking the timber. The cost of creosoting railway sleepers is about 4¼*d.* per cubic foot; that of preparing timber to resist the ravages of the worm is nearly 6*d.* per cubic foot.

The mechanical means adopted for the protection of timber from the sea-worm, are sheathing with copper, studding with iron scupper nails, and casing with cast iron.

Copper sheathing was used at Southend, but the limnoria not only penetrated between the copper and the timber, but the copper itself rapidly decayed; therefore this is not a method to be imitated.

Wrought iron nails, with heads about one inch square, driven into the piles close together, is an effectual preservative; the iron corrodes, and forms a solid impenetrable rust entirely over the timber. The cost is about 11*d.* per superficial foot. Casings of cast iron are not more effectual, and are much more costly.

A plan stated to be effectual at the Herne Bay pier, may be employed in countries where the above modes cannot be followed. A wooden

casing was formed round each pile, leaving a space of about an inch all round, which was rammed full of lime or cement concrete; the worms commenced their ravages, but appeared to have been checked, and not to have been able to exist when so enclosed.

---

*The Philadelphia and Liverpool Screw Propeller Steam Navigation Company's New Iron Vessel, "City of Manchester."**

Built and fitted by Messrs. Tod and McGregor, engineers and iron ship-builders, Glasgow, 1851.

	British.		American.	
Builder's Measurement.	Tons.		Tons.	
Hull	$1776\frac{79}{84}$		$1756\frac{13}{95}$	
Contents of engine-space	$568\frac{93}{94}$		$563\frac{0}{95}$	
Ditto of shaft tunnel	$10\frac{58}{94}$		$10\frac{48}{95}$	
Register	$1197\frac{2}{94}$		$1184\frac{57}{95}$	
			British Act for Foreign Vessels.	
New Measurement.	Ft.	Ins.	Ft.	Ins.
Length on deck	261	8	261	8
Breadth on ditto, amidships	36	2	36	2
Depth of hold, ditto	25	3	25	3
Length of engine-room	77	7	77	7
Ditto of shaft-tunnel	79	7	79	7
Breadth of ditto	5	0	5	0
Depth of ditto	6	9	6	9
Tonnage.	Tons.		Tons.	
Hull	2109·81		1844·83	
Contents of engine-room	770·15		770·01	
Ditto of shaft-tunnel	29·75		29·75	
Register	1309·91		1044·78	

A pair of engines (beams at top) of 366 horses nominal power; diameter of cylinder 71 inches × 5 feet length of stroke; two-bladed screw, diameter 14 feet; pitch 18 feet; driving wheel, diameter 9 feet 10 inches; 93 cogs; pinion diameter 4 feet 5 inches, 42 teeth; pitch 4 inches; 4 sets of cogs, 9 inches in breadth and $1\frac{1}{2}$ inches between them; 3 tubular boilers; 9 furnaces, and 448 tubes in all; chimney 6 feet × 30 feet; 2 iron masts, fore ditto 81 feet, and second 83 feet long, and both are 2 feet $2\frac{1}{2}$ inches in diameter; frames of hull, $5 \times 3 \times \frac{5}{8}$ inches, and 18 inches apart; propeller frame $7\frac{1}{4}$ inches square; keel $9 \times 3\frac{1}{2}$ inches; plates $\frac{7}{8}$ to $\frac{3}{8}$ of an inch in thickness. Has accommodations for 180 passengers; and is manned by a crew of 86 men, 14 of which are in the engine-room. Sailed from Greenock for Belfast on the 16th of July last; arrived there in 8 hours and 10 minutes; at the rate of 13 miles per hour; sailed from

* From the London Artizan, for October, 1851.

Belfast for Liverpool (156 miles), arrived at the latter in 12 hours and 55 minutes; draft of water, forward, 12 feet, and 14 feet 6 inches aft; steam pressure 10 lbs. per square inch; the engines making an average of 25 revolutions per minute.

---

*The Glasgow and New York Screw Steam Navigation Company's Iron Vessel "Glasgow."**

Built and fitted by Messrs. Tod and McGregor, engineers and iron ship-builders, Glasgow, 1851.

Dimensions.	Ft.	Ins.
Length on deck	250	0
Breadth on ditto, amidships	35	2
Depth of hold, ditto	26	2
Length of tunnel for screw-shaft	74	0
Breadth of ditto	5	0
Depth of ditto	7	2
Length of engine-space	78	2

Tonnage.		Tons.
Hull		1,961·78
Contents of tunnel for screw-shaft,	28·83	
Ditto of engine-space	780·51	
		783·34
Register		1,152·53

A pair of engines (beams at top) of 366 horses nominal power; diameter of cylinders 71 inches × 5 feet; diameter of driving-wheel 9 feet 10 inches, having 93 cogs; diameter of pinion 4 feet 5 inches, having 42 teeth; pitch 4 inches; 4 sets of cogs; three-bladed screw, of cast-iron, 14 feet diameter; pitch 18 feet. Is fitted with Messrs. Lamb and Summers' patent sheet flue boilers, 3 in number; length 13 feet 2 inches; breadth 9 feet 3 inches; depth 15 feet 9 inches; 63 spaces, 21 in each boiler, and 7 opposite each furnace; length 7 feet; breadth $1\frac{3}{4}$ inch; depth 3 feet 6 inches; 9 furnaces, 3 in each boiler; length 7 feet 3 inches; breadth 2 feet 4 inches; depth 4 feet; chimney 6 feet × 30 feet; frames of hull $5 \times 3 \times \frac{5}{8}$ inches, and 18 inches apart; keel $8\frac{3}{4} \times 3\frac{1}{2}$ inches; propeller-frame $7\frac{1}{4}$ inches square; 2 iron masts; the foremast is 81 feet long, and the second is 83 feet long, and 2 feet $2\frac{1}{2}$ inches diameter: they are painted in imitation of wood. She will carry a cargo of 1763·36 tons, (which includes 600 tons of coals, stores, &c.,) and has accommodations for 170 passengers.

She was launched from the building-yard, Meadowside, on Saturday, the 16th of August, the draft of water being, forward 6 feet 9 inches, aft 7 feet 7 inches. On the trial trip, September 5th, she sailed out as far as Pladda, and went from the clock to the Cumbrae light-houses (a distance of 15·6 miles) in 74 minutes, or at the rate of $12\frac{1}{2}$ miles per hour, having a plentiful supply of steam, the screw making about 60 revolutions per minute. The *Glasgow* sailed from the Clyde to New York on

* From the London Artizan, November, 1851.

the 16th of September, on the first voyage outward, being only one month from the launch to day of sailing.

For the Journal of the Franklin Institute.

Notes on the U. S. Steamer "Iris." By Chief Engineer, B. F. Isherwood, *United States Navy.*

The U. S. Steamer "Iris" was originally a vessel bought into the Navy from the merchant service in 1847. She made but one short cruise to the Gulf of Mexico, when, proving entirely unadapted for naval purposes, she was sold out of the service, and under the name of the "Osprey," now plies between Philadelphia and Charleston.

Hull.—Length on deck, 145 feet; breadth of beam, 27 feet; depth of hold, 11 feet; burthen, 388 tons; immersed amidship area of hull, 229 square feet; mean draft of water, 9 feet 9 inches.

Engine.—One piston rod, condensing steeple engine; diameter of cylinder, 54 inches; stroke of piston, 6 feet; space displacement of piston per stroke, 95·424 cubic feet.

Paddle Wheel.—Of the common radial kind; diameter 23 feet; number of paddles in wheel, 20; length of paddle, 6 feet; breadth of paddle, 2 feet 4 inches; area of one paddle, 14 square feet; mean immersion of lower edge of paddle, $3\frac{1}{4}$ feet; $4\frac{1}{2}$ paddles in water with centre paddle vertical.

Performance.—The logs of the vessel give her performance for 445 hours steaming, using anthracite coal with a fan blast; and for 552 hours steaming, using bituminous coal with a natural draft.

The mean of her performance with anthracite coal was as follows: Speed of vessel, 6·586 knots of $6082\frac{2}{3}$ feet per hour; double strokes of piston per minute, 11·512; steam pressure in boiler above atmosphere, 21·8 pounds; anthracite coal consumed per hour, 946 pounds. Throttle one-fourth open; steam cut off at half stroke.

The mean of her performance with bituminous coal was as follows: Speed of vessel, 6·824 knots per hour; double strokes of piston per minute, 12·491; steam pressure in boiler above atmosphere, 12·5 pounds; bituminous coal consumed per hour, 1025 pounds; throttle wide open; steam cut-off at half stroke.

The mean speed of vessel for the entire 997 hours, was 6·718 knots; double strokes of piston per minute, 12·054.

Owing to the *throttling off* when the anthracite was used, it is impossible to tell, in the absence of indicator diagrams, with any approach to reasonable accuracy, what was the initial steam pressure in the cylinder; the comparison of the relative economical evaporation of the two kinds of coal must be made from the weights of coal consumed per hour, and the cubes of the speeds of the vessel (supposing the resistances to the vessel to be the same,) as the measure of the effects. Because the powers will be as the steam used, (supposing the same back pressures in the cylinders in both cases,) the same degree of expansion for the steam being employed in both cases; and the powers are measured by the cubes of the speeds.

The consumption of coal in the two cases is 946 pounds and 1025 pounds per hour; the speeds 6·586 knots and 6·824 knots per hour; reducing these to proportionals, we have

Anthracite,	1·0000	Speed,	$1\cdot0000^3 = 1\cdot0090$
Bituminous,	1·0835	"	$1\cdot0361^3 = 1\cdot1122$

whence it appears that the economical evaporation of the bituminous is $\left(\frac{1\cdot1122}{1\cdot0835}\right)$ better than the anthracite's in the proportion of 1·0265 to 1·0000.

As, however, both the resistances to the vessel, owing to variations of draft and variable conditions of sea and weather, and the back pressure in the cylinder, constantly varied, though within such slight limits that the means on which the comparison is founded, probably present a correct relation; yet we are not entitled with so trifling a difference as the result shows, to conclude practically, other, that in the boilers of the Iris, both kinds of fuel produced equal effects. There is no reason for supposing that the losses of heat by *foaming* or *priming*, leakage of the cylinder valves and piston, and by *blowing off*, were not the same in both cases. The anthracite also furnished the steam for the small engine driving the fan blower, which effect is not included in the above calculation.

Power.—The actual power developed by the engine can be obtained with sufficient accuracy, from the data, when using bituminous coal. The throttle being wide, the initial cylinder pressure would be about 2 pounds less than the boiler pressure. The space comprised between the steam valve (which was also the cut off valve) and piston, including clearance, &c., is 2·464 cubic feet, or equivalent to a cylinder of 54 in. diameter, and 0·154 foot long. The steam was cut off at half stroke of piston; the boiler pressure was $12\frac{1}{2}$ pounds above the atmosphere, and allowing the initial cylinder pressure to be 2·2 pounds less than the boiler pressure; the total initial cylinder pressure would be 25 pounds per square inch; 3·154 of this steam would be expanded into 6·154, and give a mean pressure throughout the stroke of 21·31 pounds. The back pressure in the condenser was per gauge, 2·2 pounds, and allowing the back pressure in the cylinder to exceed it by 2.11 pounds, there would be a total of 4·31 pounds back pressure to be deducted, leaving the mean effective pressure throughout the stroke, (21·31—4·31,) 17 pounds per square inch.

$$\frac{2290\cdot22 \text{ ar. cyl. in sq. in.} \times 17 \times 12\cdot491 \text{ double st. pist. per. min.} \times 12 \text{ ft. length double stroke.}}{33000}$$

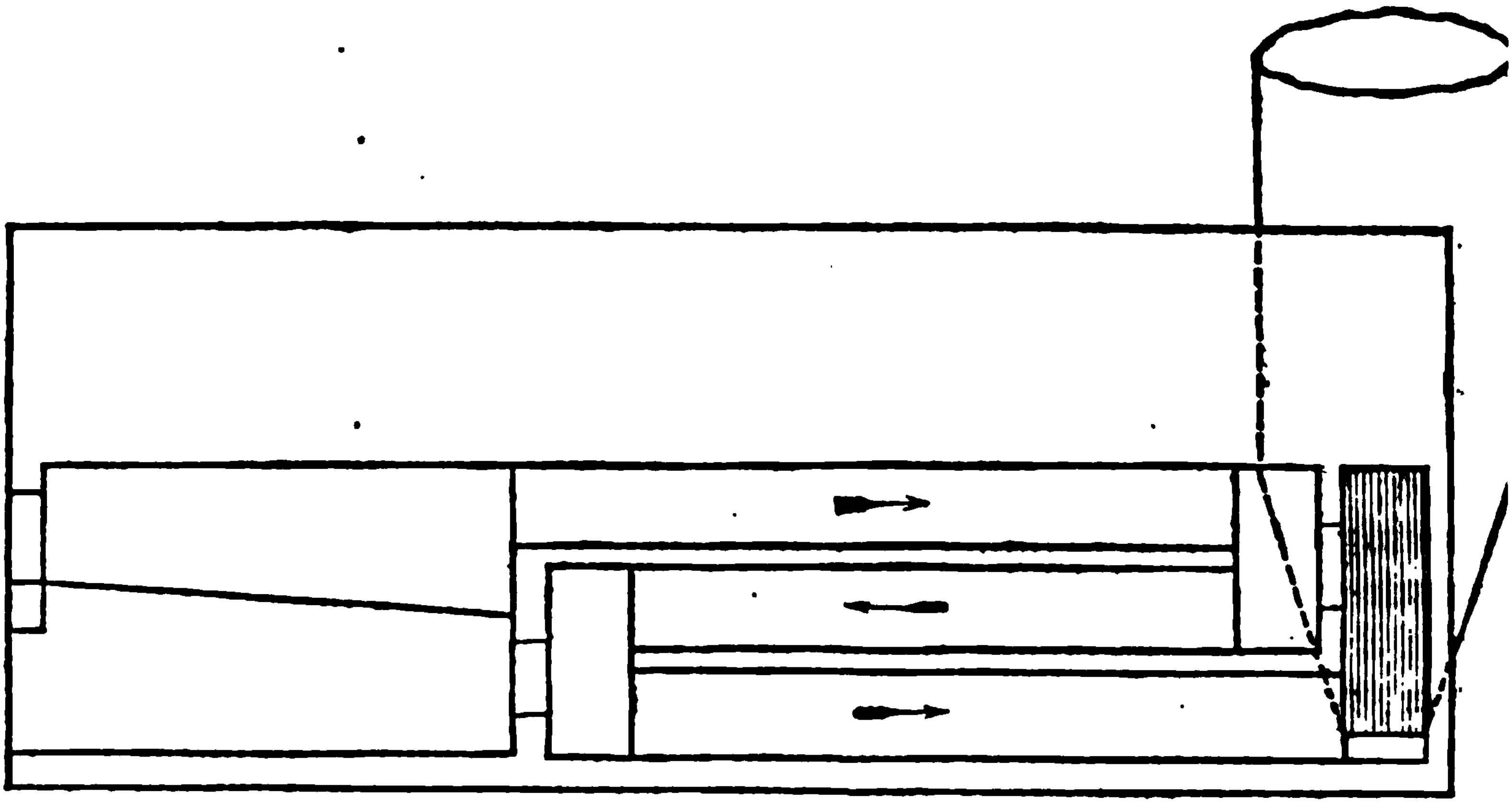
$= 176\cdot844$ horses power.

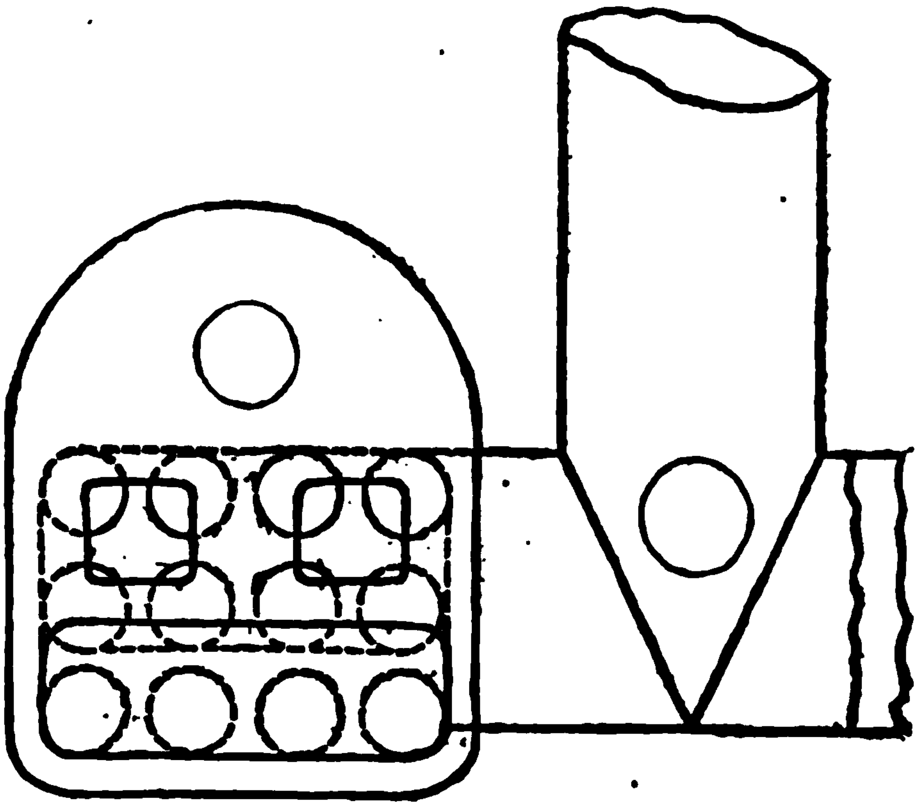
Boilers.—The boilers were of iron, and two in number, of the double return drop flue kind, as shown in the annexed sketch.

Length of each boiler, ...	23 feet.
Breadth of "	6 feet 10 inches.
Height of "	8 " 3 "
Cubic contents of circumscribing parallelopipedon of each boiler,	$1296\frac{2}{3}$ cubic feet.
Area of heating surface in the two boilers, . . .	1420 square feet.
" grate " " " . . .	80 "
Cross area of each of the three rows of flues ($14\frac{1}{2}$ in. diam.) in the two boilers, ...	9·17 "
Cross area of smoke chimney, ...	11·54 "
Height of smoke chimney above grate, ...	40 feet.

PROPORTIONS.

Proportion of heating to grate surface, ...	17·75 to 1·00	
" grate surface to cross area of each of the three rows of flues in the two boilers,	8·724 to 1·00	
" " smoke chimney, . .	6·932	"
" heating " each of the three rows of flues in the two boilers,	154·853	"
" " smoke chimney, .	123·050	"
" " cubic foot of space displacement of pist.	14·881	"
per double stroke of piston per minute,	1·191	"
" grate " " .	0·067	"
" " " space displacement of pist.	0·838	"
Consumption of bituminous coal with natural draft per square foot of grate surface per hour,	12·812	pounds
" anthracite " fan blast . .	11·825	"
" bituminous " natural draft heating	0·722	"
" anthracite " fan blast . . .	0·666	"
Sea water evaporated by one pound of bituminous coal per hour,	5·118	"
Sea water evaporated by one square foot of heating surface per hour, burning bituminous coal, ...	3·624	"





The steam being cut off at half stroke of piston, there would be fille per stroke ($\frac{95\cdot424}{2}$) 47·712 cubic feet, to which must be added 2·46

cubic feet comprised between the cut off valve and piston, making 50·176 cubic feet, which, multiplied by the number of strokes per minute, viz: 24·982, and then by 60, gives 75209·81 cubic feet of steam of 25 pounds per square inch total pressure per hour. The relative volumes of steam of this density and water, is as 1044 to 1, and 75209·81 ÷ 1044 = 72·04, which, multiplied by 64·3 pounds, the weight of a cubic foot of sea-water, gives 4632·172 pounds of sea-water evaporated per hour by 1025 pounds of bituminous coal, or 4·519 pounds of water per pound of coal. To this must be added the loss by blowing off, obtained as follows:

The density of the water in the boiler being carried at $\frac{2}{32}$ of *Sewell's Salinometer*, one-half of the whole quantity pumped into the boiler would be blown out, leaving the other half to be evaporated. The water was furnished to the boiler from the reservoir, at a temperature of 100° F.; the temperature of the steam, and consequently of the water in the boiler, corresponding to a total pressure of 27·2 pounds, was 246° F.—the loss of heat in the blown out water was therefore 146° F. The total heat of steam being taken at 1202° F., and the temperature of the feed water being 100° F., there was left to be furnished by the fuel 1102° F. The total quantity of heat then furnished by the fuel was 146 + 1102 = 1248° F., of which 146° was lost by *blowing out*, and 146 is 11·7 per cent of 1248. Out of every 100 of fuel burnt, there is then 11·7 lost, and 88·3 utilized; and if 88·3 give 4·519, 100 would give 5·118. There was therefore evaporated by each pound of bituminous coal, 5·118 pounds of sea-water.

Proceeding in the same manner, there will be found to be evaporated per hour, per square foot of heating surface, 3.624 pounds of sea-water.

As it is possible to attain an evaporation of 8 pounds of water per pound of coal in marine boilers of proper proportions, let us examine why the boilers of the "Iris" gave so inferior a result.

The first essential is, that the fuel be supplied with a sufficient quantity of atmospheric air to oxidize the components of the fuel, and this quantity will mainly be determined by the cross area of the flues or *calorimeter*, modified by amount of heating, or heat absorbing surface and height of smoke chimney.

With the proportion of heating to grate surface of 17¾ to 1, and a consumption of 12.812 pounds coal per square foot of grate per hour, the heated gases would be delivered into the chimney at the temperature of about 420° F., the chimney being 40 feet high above the grate, the velocity of draught calculated from Buchanan's formulæ would be 25.8 feet per second.

According to the experiments of Professor Walter R. Johnson on Maryland bituminous coals, the kind used with this boiler, there are required for the perfect combustion of one pound, 237·21 cubic feet of atmospheric air at standard temperature of 60° F., and pressure of 30 inches barometer; there would consequently be required to enter the grates per hour (237·21 × 12·812 × 80) 243,130·76 cubic feet of air, which will contain 48,626·15 cubic feet of oxygen entering into chemical combination with the constituents of the coal.

Of the combined oxygen, the portion that enters into chemical combination with the fixed carbon, compared to that which enters into chemical union

with the bitumen of the coal, (supposing, as is the case with Maryland coals, that the fixed carbon is 75 per cent., and the bitumen 14 per cent., the remainder being earthy matters, &c.,) is in the proportion of 200 to 112; consequently there would unite with the fixed carbon 31,170·6, and with the bitumen 17,455·55 cubic feet of oxygen; and as carbon unites with oxygen by volume in the proportion of $\frac{1}{2}$ to 1, the sum of the volumes would be 46,755·9 cubic feet, which by that union condenses into the original volume of oxygen, viz: 31,170·6 cubic feet.

As hydrogen, the principal constituent of the bitumen, requires only one volume of oxygen to two volumes of itself, the resulting bulk would be 52,336·65 cubic feet, which by the chemical union condense into the original bulk of the hydrogen, viz: 34,891·1 cubic feet.

After the deduction of the 48,626.15 cubic feet of oxygen from the total bulk of air required, viz: 243,130·76 cubic feet, there remains 194,504·61 cubic feet of uncombined nitrogen.

The bulk of gases in the cold state, required to pass through the flues of the boilers per hour, would be 243,130·76 × 31,170·60 × 34,891·10 = 309,192.46 cubic feet.

Supposing the temperature of the air entering the ash-pits to be 60° F., and that of the heated gases entering into the flues 1060° F., the gases would have received 1000° of temperature; and as the fixed airs expand $\frac{1}{479}$th their bulk for each degree of temperature, the 309,192·46 cubic feet would be increased to 954,688·20 cubic feet.

Now the cross area of the flues is 9·17 square feet, and the velocity o the draft in the chimney per hour is (25·8 × 60 × 60) 92,880 feet, the bulk of gases passed per hour is then (92,880 × 9·17) 851,709·6 cubic feet. Consequently the calorimeter is not large enough to pass the prope amount of air by 12 per cent. were the combustion *perfect;* that is, di all the oxygen enter into *full* chemical combination with the constituent of the coal.

In practice, however, this is impossible to effect, from want of time an sufficient mixing of the gases, so as to bring molecule of oxygen in contact with molecule of coal constituent; and analyses of the products o combustion taken from the flues of steam boilers show that 50 per cent of the entering oxygen passes off uncombined. In *practice,* therefore the calorimeter should be made double the *theoretical* dimension. Th proportion of calorimeter to grate in the boiler of the "Iris" is 1·000 t 8·724; more than double this proportion, or about 1·000 to 4, woul therefore be a proper dimension in practice, burning the same amount c coal per square foot of grate per hour.

After having generated the caloric most economically by such a prope proportion of the calorimeter as would allow the oxygen to be presen in sufficient quantity to ensure the saturation of the coal constituents, th next thing to be done is to provide a sufficient quantity of heat absorb ing surface to conduct it into the water. Here again a much higher pro portion than what is usually given in practice, will be found desirabl It can be made as high as 35 or 40 of heating to 1 of grate surface, ad vantageously—bearing in mind, however, that each addition to the heat ing surface, by abstracting caloric, reduces the draft, and diminishing th

consumption of coal on the grate per unit of time, diminishes generally, also, the potential, though it increases the economical evaporative result.

Losses of Labor by the Paddle-wheel.—The speed of the vessel being 6·824 knots of 6082⅔ feet, the circumference of the centre of reaction of the paddles 67·60 feet, and the number of revolutions of the wheels per minute 12·491, their slip would be as follows:

6·824 × 6082⅔ = 41508·12 speed of vessel, in feet, per hour.
67·6 × 12·491 × 60 = 50663·50 " centre of reaction of paddle per hour, in feet.
9155·38 slip per hour, in feet.

Or 18·07 per cent.

The loss by the oblique action of the paddles, calculated as the squares of the sines of their angles of incidence on the water, is 12·89 per cent.

The total losses by the paddle-wheel would then be (18·07+12·89) 30·96 per cent.

The following proportions will be found useful in practice:

Square feet of immersed amidships section of vessel to square foot of paddle		(taking the area of two paddles only)	8·179 to 1·000	
Do.	do.	(taking the area of *all* the immersed paddles)	1·817	"
Do.	do.	cubic foot of space displacement of steam piston	2·400	"
Do.	do.	do. per double stroke of piston per minute	0·192	"

For the Journal of the Franklin Institute.

English Modesty.

Our friends across the Atlantic are in a fair way of carrying off all the honors connected with marine navigation, if we allow them to take that liberty unopposed, and the *cool impudence* of the thing is most surprising; for instance, the following article is published in the *Builder* for October 11th, 1851, No. 454, p. 658, claiming that the machinery of the Collins' line of steamers was not only copied from the Cunard line, but that engineers and hands were imported from the Clyde into New York for the purpose of constructing their machinery, and that this was one of the conditions on which the United States government granted the contract to Mr. Collins.

"*British and American Steamers.*—In your number of the 4th inst. you quoted an extract from an American paper, in which it is stated that improvements made in the steam engine by Americans, have been adopted in building the "last fast" boats of the Cunard line, and that in the "extra fast boats" of the same line now in course of construction, "they are to go the whole figure, and fashion the engines entirely after the most approved American models." By giving currency, as you have done on this and other recent occasions, without comment, to the overweening estimate which the Americans form of their own superiority, you appear to me, Mr. Editor, to do much towards weakening the well-founded confidence which has hitherto been entertained in the perfection of British machinery, thereby injuring British interests, particularly with reference to the demands for engines from foreigners.

It is time, therefore, that the real facts of the case respecting the manufacture of the engines on board Collins' American line of steamers (the vessels more immediately alluded to in the American newspaper) should be made known, which I now do from undoubted authority, and, as regards some of the particulars, from my own knowledge,—and which are as follows:—

The United States Government, perceiving the failure of all the attempts that had been made to establish an American line of Atlantic steamers, which should compete in point of speed and efficiency with the Cunard line, and deeming it of the greatest national importance that this inferiority should no longer continue, subsidized, with a large annual subvention, Collins' line, (besides, it is believed, giving pecuniary aid in some shape or other towards the construction of the vessels,) on condition that no expense should be spared in obtaining the most perfect and efficient engines that could be constructed; and

as there was at that time (although it is only two years ago) no manufacturer in the United States who could make engines fulfilling these conditions, the contractors for the American line turned their views towards the Clyde, and obtained permission from the proprietors of the Cunard line to take mouldings or castings of every part, even to the minutest particular, of the engines constructed by Napier, of Glasgow, on board the largest of their vessels; and in order that nothing might be wanting to make the engines equal to those in the Cunard steamers, the contractors imported men from the manufactories on the Clyde for the purpose of making the engines in New York, so that they might be of national or American fabric.

As, therefore, the last constructed and fastest of the American or ocean-going steamers are made entirely after the British model and by "Britishers," you will perceive, Mr. Editor, how little likely it is that the Cunard vessels now in course of construction are to be fitted with engines made after the American model. Where, indeed, have the Americans anything better to show than the engines on board the Collins' line, which are made after the British model? . . BRITANNICUS."

There is not *one word* of truth in the above article, so far as it relates to the construction of the machinery of the Collins' steamers, and it has emanated from one who is entirely ignorant of what he is writing about, and in his zeal to protect the credit of the Cunard line for speed, has either ignorantly, or by design, written the article to blind his countrymen as to the truth, for it is *rather* mortifying to be beat by Brother Jonathan on a field that two years since was controlled entirely by Great Britain. Now for a few facts; the machinery for the Atlantic and Arctic was designed and constructed at the Novelty Works, New York, whose engineer, T. B. Stillman, Esq., (the senior member of the firm) is a Yankee from the valley of the Mohawk, and I am quite positive has never visited England, at any rate has not been there for the last five years. The engines for these two ships were designed and constructed under his immediate supervision. The engines for the Pacific and Baltic were constructed at the Allaire Works, and were designed by Charles W. Copeland, Esq., engineer of the works, (another Yankee from Connecticut,) and constructed under his supervision. The chief engineer of the line, John Faron, Esq., was I believe born in Ireland, and came to this country when about two years old, at which time we may fairly infer he had not imbibed many ideas on marine navigation. Mr. F. was superintending engineer on the part of Mr. Collins, and it is understood, designed the boilers of all the vessels.

If the writer in the *Builder* can from the above statement, (which is strictly true,) make out that the engines were copied from the Clyde, and designed and built by English engineers, I should be happy to hear his argument. I can, however, I think, give him a hand to help him out of his dilemma. The engines of the Ohio and Georgia, Chagres and New Orleans steamers, were designed by an engineer from the Clyde, (Mr. Tothill,) and constructed under his supervision at the then works of T. F. Secor & Co., (now Morgan Iron Works,) New York; they are of the same size and have a strong resemblance to the engines of the Cunard steamers Europa and Niagara, but are improved in having balance valves, by which one man can work each engine, instead of requiring three, the usual practice on the Clyde. The boilers are also essentially different from those of the English steamers.

Those who pay any attention to the English papers, must well remember that it was a long time before *they* would admit that the Collins'

line were the equal in speed of the Cunard steamers; but now that they are obliged to admit the truth, and own that they are beaten, they turn round with all the coolness imaginable, and actually call it a triumph of English engineering.

What they have claimed as to the Collins' steamers, they are now asserting in relation to the yacht America. Most persons on this side of the Atlantic have supposed that she was built by William H. Brown, Esq., of New York, and that she was designed by his foreman, Mr. Steers, and that good or bad, she was truly the production of this country; they have also the impression, that while building, drawings were taken of her on the stocks, and published in several of the English papers, and that those papers all spoke of her peculiar form, and not one of them claimed her as being built from an English model; but all this was before the race; no sooner is that over, than several English papers discover a very strong resemblance to some of the fishing boats on their coast; others are more definite, for instance, the *London Mechanics' Magazine*, October number, page 289, says, "It turns out that among other novelties, she had *sliding keels*, and probably this contributed not a little to her triumph. Sliding keels, however, are well known to have been the invention of the late British Admiral Sir John Schank."

Now it is a well known fact, in this country at least, that the use of centre boards or sliding keels, as they are termed in England, dates farther back than the memory of the oldest inhabitant, and at the risk of disturbing the ashes of Sir John Schank, I must say he had nothing to do with their invention in this country; nearly every river sloop in the vicinity of New York, at least as long back as the memory of man goeth, used them, and the date of their invention was as great a mystery then as now. Another English writer says, the America is modelled on the wave principle, and therefore she is an English model, because Mr. John Scott Russell is the inventor of the system; that Mr. Russell has done much to beat a little common sense into the heads of some of the ship builders of England, I allow. He has undoubtedly for years past seen, that while the models of our ships were being constantly improved, yet in England they were all but stationary, and an English merchantman could be readily told from her build, no matter what flag she might carry or how much they might attempt to disguise her. There has not been during the last twenty years a single English regular packet ship trading to this country, their inferiority being universally conceded. Mr. Russell, fully aware of this, has adopted essentially the theory and practice of some of our best builders; that he *thinks* he is original in his ideas, I am willing to admit, for I have watched for years past his efforts, and he may perhaps claim the merit of being the originator so far as his own country is concerned; but when he claims, *as he is now doing*, that we are adopting *his ideas*, it is carrying the joke too far. In the *London Architect* for August, Mr. Russell claims, that his system has been generally adopted in this country; that our present practice and Mr. Russell's may assimilate is quite possible, but ours has been of a gradual native growth, and if it has any merit it belongs to our own ship builders, with whom it originated, and who have gradually carried it forward to its present position of triumph. Mr. Russell states, that the yacht *Titania*, the competitor of the America,

was modelled on his system, which I am glad to know, as the two vessels being essentially different, he cannot then claim the America.

The next move, I suppose, will be to call Com. Stevens, who sailed the America, an Englishman, and then the whole thing will be complete. How contemptible is that spirit that cannot see good in another; for my part, I allow that we have gained much knowledge from an examination of the machinery of the various English steam ships that have visited us, and this kindness we shall fully repay by teaching brother John how to model a ship. B.

For the Journal of the Franklin Institute.

Remarks on J. W. Nystrom's Remarks on the Propeller and Steam Engine of the War Steamer "San Jacinto." By J. V. Merrick.

The readers of this Journal, in perusing various calculations and remarks inserted on former occasions in its pages by Mr. J. W. Nystrom, on the subject of Marine Propulsion, may have been a little surprised at the facility with which sundry disputed points were disposed of, and observed results of experience set at nought, when brought to the *test* of theory, unsupported either by proof or probability. Without desiring in this connexion to quarrel with the positions taken by Mr. N. in his former articles, I feel too much interest in the subject of his last one, (in the Dec. No., pp. 402-404,) to forbear venturing a word or two regarding some remarks he has therein seen fit to make on a Report of the recent trial trip of the U. S. steamer San Jacinto; in the course of which remarks we are gravely informed that the "slip" is falsely reported, because it does not correspond with the result of an empirical formula, and with his opinion of what *ought to be* the slip under the circumstances. Happening to know some of the facts of this case, I can inform Mr. Nystrom that not only is the slip of the San Jacinto correctly reported by Mr. Isherwood, (that is, if any reliance is to be placed on the Charts of the U. S. Coast Survey, and the observed time, compared by several competent and disinterested individuals,) but that furthermore, other instances might be adduced to show that 26¼ per cent. slip is not remarkable, as being either very small or very great, in a vessel of her resistance and propelling area; but is simply about what might be predicted, by those who predicate their judgment on former experience. It may also be observed that, so far from anticipating a passage from Liverpool to Halifax in 5·78 days, because her propeller has a slip of only 26¼ per cent. in still water, it is much more likely that the San Jacinto will not accomplish it in less than ten days. To appreciate the force of Mr. N.'s argument, it is merely necessary to suggest, 1st, that heavy weather at sea, or even a very slight swell, is, unfortunately, apt to increase the slip of all propelling agents; and, 2d, although Mr. N. announces that "there would be no difficulty in giving the propeller 50 revolutions per minute," it is almost certain that not even 31 revolutions (the number on the trial) will ever be attained at sea, when the ship has her full supply of coals, provisions, and stores, and where the water is rarely at rest. It would be easy by such a mode of calculation, to argue a six days' passage as possible for the Col-

lins' steamers; because if there is "no difficulty" in giving their paddle wheels an increased number of revolutions in the ratio of 31 to 50: then, as the Pacific has already accomplished the trip in 9 days 20 hours, she of course can do it in $\frac{9 \cdot 83 \times 31}{50} = 6 \cdot 1$ days. It is scarcely necessary to say that the difficulty in the way of speed exists precisely in this point; the number of revolutions can *not* be increased ad libitum.

But there is another remark which calls for notice. Mr. N., to demonstrate that slip is not loss of effect, says, after calculating what would be the vessel's speed if there were no slip, that, "as there is no slip in the water, the propeller is of no use for propelling the vessel; it can as well be taken off, and the remainder will be 375·92 horse power from the *steam engine, which will drive the vessel* 15 *miles an hour with no propeller !!!*"

Admitting the principle involved in this declaration, it is equally clear that wheels are entirely unnecessary to the functions of a locomotive engine, because in that case there is no slip, and consequently the wheels may be taken off, and the remainder will be the whole effective power of the engine, which will drive the locomotive at — miles per hour, *without wheels.*

Is it necessary to remind Mr. N., that "slip" is nothing more than recession of the fulcrum against which the paddle or propeller blade acts? and that therefore the loss involved in it, is a loss of space passed over in a given time; hence a loss of velocity; and therefore that it is what is commonly called "loss of effect," or more correctly speaking, loss of useful effect.

This article has already so far transcended the limits within which I had proposed to retain it, that for the demonstration of the above stated principle, I must appeal to the reflection of Mr. Nystrom, and of those (if any) who, persuaded by his denial, may have allowed themselves for a moment to doubt the truth of a theory so well established.

For the Journal of the Franklin Institute.

Practical Rule for finding the Thickness of Cast Iron Water Pipes. By JOHN C. TRAUTWINE, *Civ. Eng.*

Books afford to practical men no guide by which to determine the thickness of cast iron pipes for resisting the pressures of different heads of water. Most authors who allude to the subject, content themselves with merely giving theoretical rules, which are well known to furnish results entirely too low for use in practice.

Thus, Barlow's Rule gives, for a 16-inch pipe to support a head of 100 feet, a thickness of but $\frac{1}{100}$th part of an inch, or about twice that of a sheet of ordinary letter paper.

Other writers, again, give the results of some very incomplete experiments, altogether too limited in number to serve as general data; while others either pass over the subject in silence, or at most, with an intimation that it admits of no specific instructions.

The fact that the theoretical thicknesses are so entirely insufficient for

practice, appears to have deterred scientific men from a more thorough investigation of the cause; and practical ones have, in consequence, been compelled to adopt such limited results of experience as they could chance to obtain, taking care generally to err on the safe side. In some instances, this precaution has been attended with useless expenditures of heavy sums of money.

The principles involved in the investigation of this subject, although presenting difficulties to a scientific solution, admit, as I conceive, of a simple and sufficiently satisfactory one in practice.

Mr. Barlow, in giving his Rule, (see the Transactions of the Institution of Civil Engineers,) assumed the *safe* cohesive strength of cast iron at 18,000 pounds per square inch; but Hodgkinson has since conclusively shown by numerous experiments, that it is not safe to employ more than 15,000 pounds per square inch as the *ultimate* cohesive strength of ordinary cast iron. This being the case, I have assumed 5000 pounds per square inch as the *safe* limit for water pipes, abstractedly considered; and modifying Barlow's Rule in this particular only, have prepared the following table. But it will be evident to any one practically conversant with the subject, that even the thicknesses given by the table are not sufficiently great for actual use, and the question arises, why are they not so? The answer appears to be simply this—that in the smaller pipes a greater thickness is necessary to ensure safety from breaking while being transported, handled, and laid; and that, in both small and large ones, it is extremely difficult to cast them of the proper lengths, and at the same time of an *uniform thickness*, and without more or less imperfection from air bubbles, &c. Consequently an excess becomes necessary, in order to counteract these sources of weakness. Moreover, after the pipes are laid, the soil below them may settle unequally, and a greater or less length of pipe may thus become a kind of tubular girder, sustaining the mass of earth which rests upon its upper side.

From a careful examination of a great number of instances collected from various sources, I conceive that I am warranted in asserting that the additional thickness required to guard against irregularities in the casting will at the same time suffice for security in handling, and for as great a resistance to fracture, from unequal settlement, as we shall find it expedient to aim at in ordinary practice. Any attempt to obviate the last difficulty *entirely*, would in many cases be attended with an expense so great as to restrict the use of water pipes within very narrow limits. It is generally advisable, therefore, not to make the attempt, but to submit to the *comparatively* trifling inconvenience of those occasional fractures which almost invariably attend the execution of extensive systems of water pipes.

Water pipes of the usual length of about 9 feet, cannot well be cast of a less thickness than ⅜-in., and in very large pipes, ⅝-in. is not too great an excess over the calculated thickness, to allow for irregularities and defects in the castings. Therefore, I will venture to offer the following as a practical rule for the thickness of cast iron pipes, to sustain safely different heads of water under ordinary circumstances, viz:

To the thicknesses given in the following table, add ⅜-in. for all pipes under 12 inches diameter; ½-in. for those of from 12 to 30 inches; and ⅝-in

for those of from 30 to 48 inches diameter. Or, if it should be considered expedient to allow something for rusting, *add respectively,* ½, ⅝, *and* ¾-*in., instead of* ⅜, ½, *and* ⅝-*in.*

Inner diameter or bore of Pipe in inches.	HEAD OF WATER IN FEET.															
	100	150	200	250	300	400	500	600	800	1000	1200	1400	1600	2000	2500	3000
	Pressure of Water against sides of Pipe, in pounds per square inch.															
	43·4	65·1	87	109	130	174	217	260	347	434	521	608	694	868	1085	1302
	Thickness of Pipe in inches.															
2	·009	·013	·018	·022	·027	·036	·045	·055	·075	·095	·116	·139	·161	·210	·277	·352
3	·013	·020	·026	·033	·040	·054	·068	·082	·112	·143	·173	·207	·242	·315	·417	·530
4	·017	·026	·036	·045	·053	·072	·090	·110	·149	·191	·232	·278	·322	·420	·555	·704
5	·022	·033	·044	·056	·067	·090	·113	·137	·186	·237	·290	·347	·402	·525	·695	·880
6	·026	·040	·053	·067	·080	·108	·136	·165	·224	·287	·347	·415	·485	·630	·835	1·06
7	·030	·046	·062	·078	·093	·126	·159	·193	·261	·333	·406	·485	·565	·735	·970	1·23
8	·034	·053	·071	·089	·107	·144	·181	·220	·298	·382	·465	·550	·644	·840	1·11	1·41
9	·039	·059	·079	·101	·120	·163	·205	·247	·335	·427	·520	·622	·724	·945	1·25	1·58
10	·044	·066	·089	·112	·134	·181	·227	·275	·373	·475	·580	·695	·805	1·05	1·39	1·76
12	·053	·080	[illegible]	·134	·161	·217	·273	·330	·448	·576	·695	·830	·970	1·26	1·67	2·12
14	·061	·093	·124	·156	·187	·253	·318	·387	·523	·666	·813	·970	1·13	1·47	1·94	2·47
16	·069	·106	·142	·178	·214	·288	·363	·440	·596	·763	·930	1·11	1·29	1·68	2·22	2·82
18	·078	·120	·159	·201	·242	·326	·409	·495	·670	·850	1·04	1·24	1·45	1·89	2·50	3·18
20	·088	·132	·177	·223	·267	·361	·454	·549	·746	·950	1·16	1·39	1·61	2·10	2·77	3·52
24	·105	·159	·213	·268	·321	·433	·545	·660	·895	1·15	1·39	1·66	1·94	2·52	3·33	4·23
30	·132	·198	·267	·336	·402	·543	·681	·825	1·12	1·42	1·74	2·08	2·41	3·15	4·17	5·28
36	·156	·238	[illegible]	·402	·483	·651	·819	·990	1·34	1·71	2·08	2·49	2·91	3·78	5·01	6·36
42	·184	·279	·372	·469	·562	·758	·955	1·16	1·57	2·00	2·44	2·91	3·39	4·41	5·83	7·42
48	·210	·317	·425	·535	·641	·866	1·09	1·32	1·79	2·29	2·79	3·32	3·87	5·04	6·65	8·45

Barlow's Rule.—Multiply the pressure against the inner diameter of the pipe in pounds per square inch, by half the inner diameter in inches, and divide the product by the difference between the cohesion of the metal per square inch, (assumed in the above table at 5000 lbs.,) and the pressure in pounds per square inch. The quotient will be the required thickness in inches.

Seasoning Timber. *By* SAMUEL CLEGG, JR.*

Seasoning timber is the extraction of all the vegetable juices and moisture from the woody fibre, leaving it perfectly dry and free from the effects of that unequal expansion and contraction of moisture between the fibres which causes timber to warp, twist, and crack. Seasoning is effected by natural and artificial means.

Timber loses both in dimensions and weight by seasoning, as shown in the following table of experiments, instituted in order to ascertain the weight of a cubic foot of different kinds of wood,—the foreign when first imported, those of the growth of England when felled, also the weight of each when fully seasoned, showing at the same time *the loss sustained in dimensions during the process of seasoning.*

* From the London Architect, for September, 1851.

Table of Experiments by MR. BENJAMIN COUCH, *of Plymouth Dockyard.*

Species (in the language of commerce.)	Country where produced.	What part of the tree the pieces experimented on were cut from.	Dimens'ns when first planed			Dimensions when seasoned.			Weight in air of a cubic foot in ounces avoirdupois.	
			Length.		Breadth and thickness, or diameter.	Length.		Breadth and thickness, or diameter.	When first planed.	When seasoned.
			Ft.	In.	Inches.	Ft.	In.	Inches.	oz.	oz.
Riga masts, supe'or	Russia	Butt*	7	6	18 diameter.	7	6	$17\frac{3}{4}$ diameter.	672	644
		Top	4	5	11 × 11	4	5	$10\frac{13}{16} \times 10\frac{3}{4}$	546	552†
Riga masts, infe'or	Ditto	Butt	12	0	12 diameter.	12	0	$11\frac{7}{8}$ diameter.	577	494
		Top	6	6	$8\frac{3}{4}$ diameter.	6	6	$8\frac{1}{2}$ diameter.	464	464
Pitch pine mast	Baltimore, N. America	Butt	2	6	10 × 10	2	6	$9\frac{3}{4} \times 9\frac{3}{4}$	755	741.
		Top	6	0	$7\frac{1}{2} \times 7\frac{1}{2}$	6	0	$7\frac{3}{8} \times 7\frac{3}{8}$	518	524
Yellow pine mast	Canada	Butt	2	4	18 × 18	2	4	$17\frac{7}{8} \times 17\frac{7}{8}$	683	461
		Top	5	0	16 × 16	5	0	$15\frac{7}{8} \times 15\frac{7}{8}$	495	420
White pine mast	New Brunswick .	Butt	3	11	12 × 12	3	11	$11\frac{15}{16} \times 11\frac{7}{8}$	679	436
		Top	3	11	8 × 9	3	11	$7\frac{15}{16} \times 8\frac{15}{16}$	411	368
Red pine mast	Canada	Butt	2	0	12 × 12	2	0	$11\frac{1}{4} \times 11\frac{1}{4}$	672	569
		Top	14	0	11 × 9	14	0	$10\frac{5}{8} \times 8\frac{3}{4}$	570	503
Oak	England	Butt	1	10	$12 \times 11\frac{3}{4}$	1	10	$11\frac{5}{8} \times 11\frac{3}{8}$	1113	743
		Top	2	0	$6\frac{1}{2} \times 6$	2	0	$6\frac{3}{16} \times 5\frac{1}{4}$	1071	777
Elm	Ditto	Uncertain.	4	0	11 × 11	4	0	$10\frac{1}{4} \times 10\frac{3}{4}$	940	588

* The butts and tops were cut from the same tree.

† Should it be asked, why a cubic foot of some of the pieces increases in weight in *seasoning?* the reason is, that they lost more in dimensions than in weight during that process.

For further information, see Barlow "On the Strength of Materials."

It will be perceived that in *length* no variation takes place, but in width the shrinkage is considerable; therefore it is that joints in floors, &c., laid with unseasoned timber, open, notwithstanding they may have been left quite close by the workman.

Natural seasoning is effected by removing the timber from where it has been felled as soon as possible, (the sooner the better,) and placing it in an inclined position in a dry situation, where the air may circulate freely round it; but it should not be exposed either to the sun or wind, as the unequal action caused by either would give the timber a tendency to split, by irregular drying. The lower edge of the timber should not touch the ground; and if there is more than one piece they must have air space between them. If timber can be kept for some time in a dry situation before it is cut into scantlings, it is less subject to warp and twist in drying. Lately, in some of the government yards, the timber has been laid upon cast iron bearers, instead of being laid upon refuse pieces of wood, as the refuse wood may be half rotten, and then must, in some degree, contribute to infect the sound timber. Timber, when converted into scantlings, still requires attention, even though the log from which it was cut was seasoned. It should be piled in a sloping direction, with space for air all round each piece. A drying yard should be well drained, and on no account should pools of water be allowed to stand on it. For the general purposes of the engineer, timber should be in seasoning two years before use. For joiner's work, Mr. Tredgold says four years should elapse, unless other methods than natural seasoning be resorted to.

Immersion in water has been said to facilitate the process of seasoning. Newly-cut timber placed some twelve or fourteen days entirely under water and then dried in the sun and wind, is rendered less liable to warp and crack; but it loses somewhat in strength. *Partial* immersion is destructive to timber. The theory of water-seasoning seems to be, that sap being soluble, its fermentable properties are lessened by dilution.

Seasoning timber by steaming or boiling is dangerous, for hot water, or steam, has to some extent the power of dissolving the woody fibre. Mr. Barlow says: "Although there is an obvious falling off in the strength of timber boiled for a long time, the defect is very small while the boiling or steaming is not continued beyond the proportion of an hour to an inch in thickness, which is the usual practice in the dockyards."

Davison's desiccating process for drying and seasoning timber will be found explained in the *Civil Engineer and Architects' Journal*, Vol. XII., p. 310. Heating timber in a chamber furnished with flues facilitates the evaporation of the watery particles; but heat is not the only essential required for drying—a current is likewise necessary; otherwise all the water which is thus converted into vapor will only tend to charge the chamber with steam, and it is not until this steam has arrived at a certain pressure, that it will make its escape, and the operation of drying commences. It is not only a moving, but a *rapid*, current which is the great desideratum for all drying purposes; and it is the impulsion of atmospheric air through the chamber at any required velocity, by means of a fan combined with heat under perfect control, which constitutes the desiccating process. The greener the wood the easier and more perfect is the expulsion of moisture; and at the same time, the native strength of the fibre is secured

by the immediate evaporation of all vegetable juices and moisture likely to ferment and carry on decomposition. The gums, instead of being removed, are coagulated and hardened, and the texture of the wood generally is less liable to decay. Shrinkage is said to be entirely obviated. The cost of desiccating does not exceed the interest of money sunk in laying up wood to season in the ordinary way. Timber seasoned by desiccation has its strength increased; and compared with that seasoned in the ordinary way, yellow pine is said to be increased in strength 17·6 per cent., Riga fir 20·4, and oak 14·0 per cent.

In reference to impregnating timber with any substance to preserve it from decay, that which has been completely exhausted of aqueous particles by the desiccating process is in the best possible condition to receive such substances; but more especially if timber, instead of being allowed to cool after it is removed from the desiccating chamber, is immediately plunged into a cold antiseptic.

---

*Unequal Refraction.**

On Sunday, the 14th of September, there occurred in this neighborhood—five or six miles north-east from Harwick, N. B.—a striking example of unequal refraction. At about a quarter past five in the morning, the figure of a man was seen, quite distinctly, walking in the air, at a very considerable elevation above the ground. A man and a boy walking together first noticed the appearance; and in about ten minutes after they had seen it, pointed it out to a third person.

The representation is described as being that of an old man, dressed in dark-colored clothes and an old-fashioned broad bonnet, with a walking-stick in his hand; and, when first seen, appearing to be about half a mile distant, and magnified to eight or ten feet in height. The figure was so distinct, that the nose and other features were seen; and every motion made in walking—such as the flapping of the coat-tails, the handling of the stick, stooping as if to pick up something from the ground, taking off the bonnet and wiping the forehead—was as plainly exposed as if performed by a man walking on *terra firma*, and at the same apparent distance. When first seen, the object was nearly due east, elevated at about an angle of twenty degrees, and exposed against the clear morning sky—lit up, as it was, by the rays of the approaching sun.

The observers occupied a position of very considerable altitude, and which affords an uninterrupted view across the country for fifteen or twenty miles, when it is closed by Cheviot Mountain, which lay directly in range of the object, though far below it. The course pursued by the aerial walker was north-easterly and descending; so that, at one time, he gradually disappeared altogether, the head and shoulders remaining in view some time after the lower parts had vanished. After the spectators had walked on about a mile farther, however, their course lying north-north-west, the phenomenon again became distinctly visible; and as they had been ascending, so it appeared correspondingly higher above the horizon. It was then followed by a dog, which, however, from dis-

* From the London Athenæum, September, 1851.

tortion or some other cause, could scarcely be distinguished from a sheep, only its ears appeared larger and more erect.

All this time there never appeared any ground along with the figure, which stalked with long leisurely strides athwart the clear sky; and when last seen, and when it had descended nearer to the horizon, became tinged of a lurid red by the rays of the sun, and appeared cut in two by a stripe of red cloud. From first to last, the spectacle was seen for about the space of half an hour; and when in view the second time, it appeared to be much farther off than at first—perhaps about two miles distant—though, strange to say, still distinctly and minutely visible. There would appear to have been some optical illusion or misconception as to the distance of the object; and nothing, as yet, is known of its corporeal representative.

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* Dr. L. Turnbull.

Continued from Vol. xxii, page 415.

Printing Telegraph of Alfred Vail.

The printing telegraph of Alfred Vail was proposed in September, 1837. It consists of a type wheel having on its surface the twenty-four letters of the alphabet. On the side of the wheel are twenty-four holes. The type wheel is moved circularly by means of a spring that the electro-magnetic key causes to advance at each interruption and return of the current. The paper advances under the type wheel by means of an independent clock movement.

The precision of the operation depends on the exact correspondence of the machinery, situated at the two extremities of the telegraphic lines. It is necessary that the type wheel presents the same letter at both stations, and that the clock moves at the same rate. But I believe that this system has never been put in execution. I copy from p. 169 of his work on the telegraph, the conclusions he comes to in regard to this form of telegraph:

"All electro-magnetic telegraphs require as their basis, the adoption of the *electro-magnet*, when recording the intelligence is an object, and it would seem, must be applied in a manner equivalent to the mode adopted by Prof. Morse; that is, the application of the armature to a lever, and its single movement produced by closing and breaking the circuit. It is, therefore, safe to assume that, whatever improvement in one plan may be made to increase the rapidity of the movements of those parts of the telegraph which belong to the electro-magnet, is equally applicable to any other plan, provided too much complication, already existing, does not counteract and defeat the improvement.

"Some plans, however, use an extra agent besides the electro-magnet, which is employed for measuring the time of the revolution of the type wheel, and the electro-magnet is only called in, occasionally, to make the impression. In such plans the rapidity of communication demands the

combined action, alternately, of both magnets. This, of course, increases the complication, and must certainly be considered a departure from other more simple arrangements. Whatever will reduce the inertia of mechanical movements and bring them to act with an approximate velocity, at least of the fluid itself, will increase the rapidity of transmission. The more the instrument is encumbered with the sluggish movements of material bodies, the less rapid, inevitably, must be its operation, even where several co-operating agents are assisting, in their respective spheres, to increase the rapidity of the motion. Such is the case with the several kinds of letter printing telegraphs: very weighty bodies, comparatively speaking, are set in motion, stopped, again set in motion, and along with this irregular motion, other parts perform their functions. There must be a courtesy observed among themselves, or matters do not move on as harmoniously as could be desired. This is not always the case, especially where time is the great question at issue.

"All printing telegraphs which use type, arranged upon the periphery of a wheel, must have, of necessity, these several movements, viz: the irregular revolution of the type wheel, stopping and starting at every division or letter; the movement of the machinery, called the printer; the irregular movement of the paper, at intervals, to accommodate itself to the letter to be printed; the movement of the inking apparatus, or what is not an improvement in cleanliness, paper of the character used by the manifold letter writer. So many moving parts, are so many impeding causes to increased rapidity, and are, to all intents and purposes, a *complication.*

"The requirements of a perfect instrument are: economy of construction, simplicity of arrangement, and mechanical movements, and rapidity of transmission. To use one wire is to reduce it to the lowest possible economy. If there is but one movement, and that has all the advantages which accuracy of construction, simplicity of arrangement and lightness, can bestow upon it, we might justly infer that it appeared reduced to its simplest form.

"The instrument employed by Prof. Morse has but a single movement, and that motion of a vibratory character; is light and susceptible of the most delicate structure, by which rapidity is insured; the paper is continuous in its movement, and requires no aid from the magnet to carry it.

"The only object that can be obtained by using the English letters, instead of the telegraphic letters, is, that the one is in common use, the other is not. The one is as easily read as the other; the advantage then is fanciful, and is only to be indulged in at the expense of time, and complication of machinery, increasing the expense, and producing their inevititable accompaniments, liability of derangement, care of attendance, and loss of time."

Alexander's Electric Telegraph.

I copy this account of Alexander's telegraph from the *London Mechanics' Magazine*, of November, 1837, but it was copied originally from the *Scotsman*, a paper published in Edinburgh, perhaps a month before, and a model to illustrate the nature and the operation of the telegraphic

machine, was exhibited at a meeting of the Society of Arts in Edinburgh, in October, 1837.

The model consists of a wooden chest, about five feet long, three feet wide, three feet deep at the one end, and one foot at the other. The width and depth in this model are, those which would probably be found suitable in a working machine; but it will be understood that the length in the machine may be a hundred or a thousand miles, and is limited to five feet in the model, merely for convenience. Thirty copper wires extend from end to end of the chest, and are kept apart from each other. At one end, (which for distinction's sake, we shall call the south end,) they are fastened to a horizontal line of wooden keys, precisely similar to those of a piano-forte; at the other, or north end, they terminate close to thirty small apertures equally distributed in six rows of five each, over a screen of three feet square, which forms the end of the chest. Under these apertures on the outside, are painted in black paint upon a white ground, the twenty-six letters of the alphabet, with the necessary points, the colon, semicolon, and full point, and an asterisk to denote the termination of a word. The letters occupy spaces about an inch square. The wooden keys at the other end have also the letters of the alphabet painted on them in the usual order. The wires serve merely for communication, and we shall now describe. the apparatus by which they work. This consists, at the south end, of a pair of plates, zinc and copper, forming a galvanic trough, placed under the keys; and at the north end of thirty steel magnets, about four inches long, placed close behind the letters painted on the screen. The magnets move horizontally on axes, and are poised within a flat ring of copper wire, formed of the ends of the communicating wires. On their north ends they carry small square bits of black paper, which project in front of the screen, and serve as opercula or covers to conceal the letters. When any wire is put in communication with the trough at the south end, the galvanic influence is instantly transmitted to the north end; and in accordance with a well known law discovered by Œrsted, the magnet at the end of that wire instantly turns round to the right or left, bearing with it the operculum of black paper, and unveiling a letter. When the key A, for instance, is pressed down with the finger at the south end, the wire attached to it is immediately put in communication with the trough; and the same instant the letter A at the north end is unveiled by the magnet turning to the right, and withdrawing the operculum. When the finger is removed from the key, it springs back to its place, the communication with the trough ceases, the magnet resumes its position, and the letter is again covered.

Thus, by pressing down with the finger, in succession, the keys corresponding to any word or name, we have the letters forming that word or name exhibited at the other end; the name, *Victoria* for instance, which was the maiden effort of the telegraph on Wednesday evening. In the same way we may transmit a communication of any length, using an asterisk or cross, to mark the division of one word from another, and the comma, semicolon, or full point, to make a break in a sentence, or its close. No proper experiment was made while we were present to determine the time necessary for this species of communication, but we have reason to believe, *that the letters might be* exhibited almost as rapidly

as a compositor could set them up in type. Even one-half or one-third of this speed, however, would answer perfectly well.

Galvanism, it is well known, requires a complete circuit for its operation. You must not only carry a wire to the place you mean to communicate with, but you must bring it back again to the trough. (The writer of this communication, and even Mr. Alexander, was not aware of the discovery of Steinheil, that the earth would conduct so as to return the current without the use of the second wire.—L. T.) Aware of this, our first impression was, that each letter and mark would require two wires, and the machine in these circumstances having sixty wires instead of thirty, its bulk and the complication of its parts would have been much increased. This difficulty has been obviated, however, by a simple and happy contrivance. Instead of the return wires, extending from the magnet back to the keys, they are cut short at the distance of three inches from the magnet, and all form a transverse copper rod, from which a single wire passes back to the trough, and serves for the whole letters. The telegraph, in this way, requires only thirty-one wires. We may also mention, that the communication between the keys and the trough is made by a long narrow basin filled with mercury, into which the end of the wire is plunged when the key is pressed down with the finger.

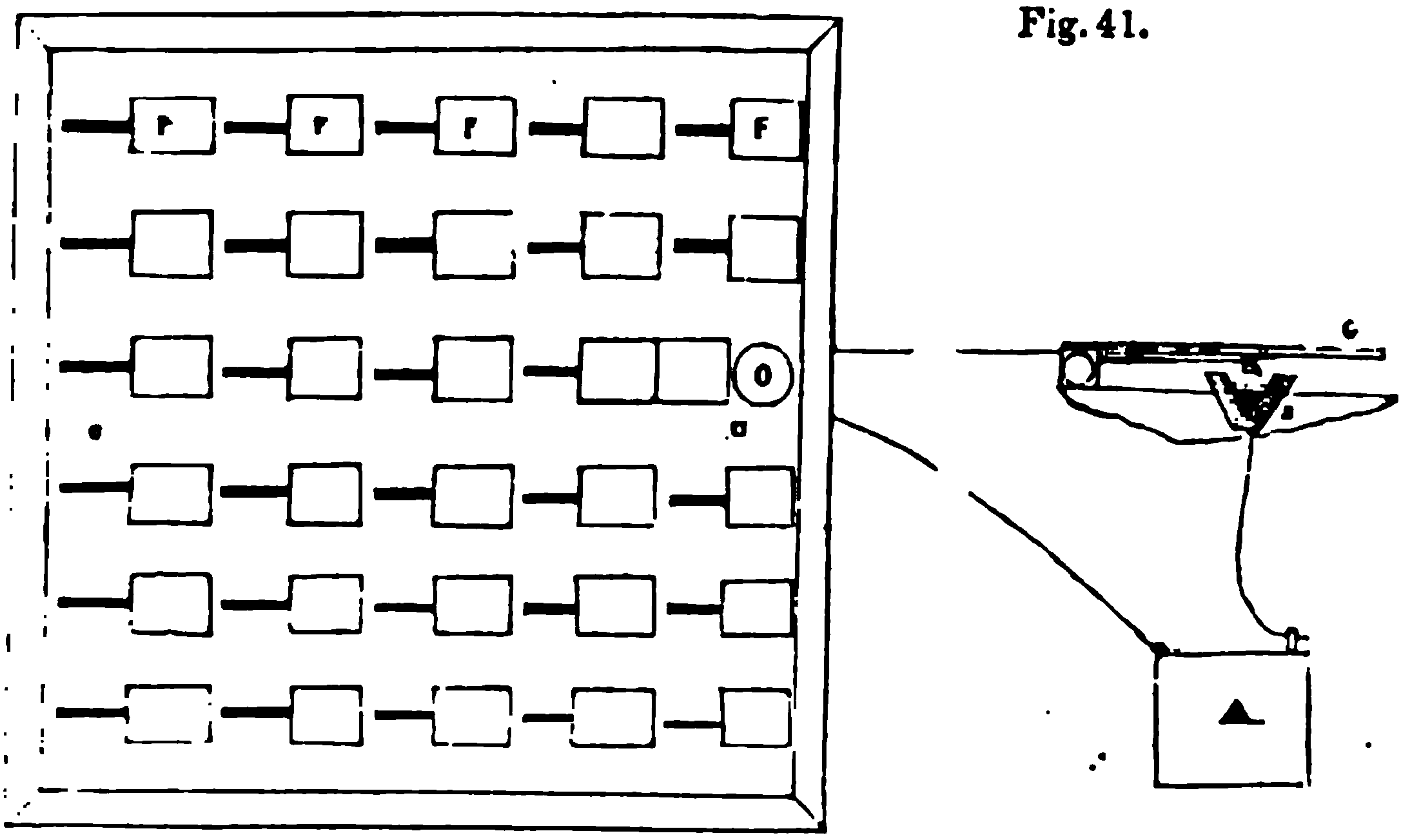
The telegraph thus constructed, operates with ease and accuracy, as many gentlemen can witness. The term model, which we have employed, is, in some respects, a misnomer. It is the actual machine, with all its essential parts, and merely circumscribed as to length by the necessity of keeping it in a room of limited dimensions. While many are laying claim to the invention, to Mr. Alexander belongs the honor of first following out the principle into all its details, meeting every difficulty, completing a definite plan, and showing it in operation. About twenty gentlemen, including some of the most eminent men of science in Edinburgh, have subscribed a memorial, stating their high opinion of the merits of the invention, and expressing their readiness to act as a committee for conducting experiments upon a greater scale, in order fully to test its practicability. This ought to be a public concern; a machine which would repeat in Edinburgh, words spoken in London, three or four minutes after they were uttered, and continue the communication for any length of time, by night or by day, and with the rapidity which has been described; such a machine reveals a new power, whose stupendous effects upon society no effort of the most vigorous imagination can anticipate.

The principle of Alexander's telegraph is represented in the following illustration from the work of Alexander Bain, Esq., fig 41. It consists of but one circuit, so as to make the operation intelligible.

A is a voltaic battery; B, a trough filled with mercury; C, a key to be pressed down by the finger of the operator; *e*, is the end of a conducting wire, which dips into the mercury when the key is depressed, and completes the electric circuit; D D, is the distant dial upon which the signals are to be shown; F F, are screens, thirty in number, each being fixed to a needle, corresponding to the finger keys before described. When no electricity is passing, these screens remain stationary over the several letters, &c., and conceal them from view; but when a current is made to flow, by the depression of a key, the corresponding needle, in

the distant instrument, is deflected, carrying the screen with it, and uncovering the letter, which becomes exposed to view, as at O.

Fig. 41.



In the same Magazine, there is an improvement suggested by a correspondent, which is obvious and a good one, namely, the use of fifteen wires to represent two letters, thus: let each of the letter screens affixed to the movable magnets be wide enough to cover two letters. Then the positive end of the galvanic battery being connected with the inducing wire, by a touch of the keys, the magnet and screen will move in one direction and discover one letter. The negative end of the battery being thus connected with the same wire, the magnet will move in the contrary direction, and discover the other letter. There must, of course, be something fixed to prevent the magnet going so far in either direction as to discover both letters. The returning wire connected with all the other thirty, must of course have its connexion with the battery poles reversed, at the same time as the lettered wire. To prevent oscillation, let each wire act upon two magnets and screens, one magnet and screen moving in one direction, but prevented from moving in the other as now. The current of electricity if reversed, would, on account of this prevention, not move this magnet and screen in the opposite direction, but it might the other magnet and screen having a similar stop or prevention, but placed on the other side of the pole.

Davy's Needle and Lamp Telegraph.

This telegraph is called the needle and lamp telegraph, to distinguish it from the telegraph of Edward Day, which I will describe in a future lecture.

"There is a case, which may serve as a desk to use in writing down the intelligence conveyed; and in this, there is an aperture about sixteen inches long, and three or four wide, facing the eyes, perfectly dark. On this the signals appear as luminous letters, or combinations of letters, with a neatness and rapidity almost magical. The field of view is so confined, that the signals can be easily caught and copied down without the necessity even of turning the head. Attention, in the first instance, is called by three strokes on a little bell; the termination of each word is indica-

ted by a single stroke. There is not the slightest difficulty in decyphering what is intended to be communicated.

"In front of the oblong trough, or box, described by your correspondent, a lamp is placed, and that side of the box next the lamp is of ground glass, through which the light is transmitted for the purpose of illuminating the letters. The oblong box is open at the top, but a plate of glass is interposed between the letters and the spectator, through which the latter reads off the letters as they are successively exposed to his view. At the opposite side of the room, a small key board is placed, (similar to that of a piano forte, but smaller,) furnished with twelve keys; eight of these have each three letters of the alphabet on their upper surfaces, marked A, B, C; D, E, F; and so on. By depressing these keys in various ways, the signals or letters are produced at the opposite desk, as previously described; how this is effected is not described by the inventor, as he *intimated* that the construction of certain parts of the apparatus *must remain* SECRET.

By the side of the key board, there is placed a small galvanic battery, from which proceeds the wire, 25 yards in length, passing round the room. Along this wire the shock is passed, and operates upon that part of the apparatus which discloses the letters or signal. The shock is distributed as follows: The underside of the signal keys are each furnished with a small projecting piece of wire, which, on depressing the keys, is made to enter a small vessel, filled with mercury, placed under the outer ends of the row of keys; a shock is instantly communicated along the wire, and a letter, or signal, is as instantly disclosed in the oblong box. By attentively looking at the effect produced, it appeared as if a dark slide were withdrawn, thereby disclosing the illuminated letter. A slight vibration of the (apparent) slide, occasionally obscuring the letter, indicated a great delicacy of action in this part of the contrivance, and although not distinctly pointed out by the inventor, is to be accounted for in the following manner: when the two ends of the wire of the galvanic apparatus are brought together, over a compass needle, the position of the needle is immediately turned, at right angles, to its former position; and again, if the needle is placed with the north point southward, and the ends of the wire again brought over it, the needle is again forced round to a position at right angles to its original one. Thus, it would appear, that the slide or cover over the letters, is poised similarly to the common needle, and that by the depression of the keys, a shock is given in such a way as to cause a motion from right to left, and *vice versa*, disclosing those letters, immediately, under the needle so operated upon."—*London Mech. Mag. Vol.* xxviii., 1837.

Masson Magneto-Electric Telegraph.

In 1837, Prof. Masson, of Caen, addressed a letter to the French Academy, in which he announced that he had made several trials with a magneto-electric telegraph, for the distance of 1800 feet. He employed for the development of the current, the magneto-electric machine of Pixü, to produce the deflexion of magnetic needles placed at the extremities of the circuits. These trials were repeated in October, 1838, with Bréquet, who was at that time one of the members of the Commission on the Telegraph from Paris to Rouen, but the results obtained were not as satisfactory as those of Steinheil, Morse, and others; afterwards Mas-

son and Bréquet associated themselves together, and invented a new form of telegraph, a description of which is not given.—*Moigno Traité de Telegraphie, p.* 30.

Amyot's Telegraph.

In a letter addressed to the Academy of Science of Paris, in July, 1838, Amyot proposed the construction of a needle telegraph. It was to consist of a single circuit, which would move a single needle, which needle was to write on paper, with mathematical precision; the correspondence which was to be transmitted to the other extremity, by a simple wheel, on which it should be written by means of points differently spaced, the same as they are on the barrels of portable organs, the wheels to be regulated by clock work.—*Moigno, p.* 31.

To be Continued.

---

*Experiments on Cement at the Great Exhibition.**

Some interesting and important experiments on the strength of cements, &c., were made on the 20th, 22d, and 23d inst., at the Great Exhibition, under the supervision of the jury of Class XXVII., when the large beam of hollow bricks and Portland cement, erected in the area at the west end of the building by Messrs. J. B. White & Sons, of Millbank, was broken down. The experiments were watched with great interest by a large number of scientific men and others. Confining ourselves for the present to the works of the firm we have named, we will record some of the experiments which preceded the attack on the beam. The weights used were iron pigs, averaging 100 lbs. each.

The first experiment was on a block of neat Portland cement 4 inches square, suspended at each end, and 16 inches long between the bearings. The weight was applied exactly in the centre. This was broken down by 1580 lbs., including the weight of the scale: the fracture was perpendicular. The block was four months old.

2. A block of neat Roman cement (Harwich stone), exactly the same size as the last, seven months old, broke down with 380 lbs. This must have been defective, and we may say, as applying throughout, that single experiments on the strength of materials must never be trusted to for general deductions, the most extraordinary variations being often found in specimens prepared under, what may be considered, precisely the same circumstances.

3. A block of neat Sheppy cement, the same size as the last, broke with 980 lbs. in the scale.

4. A block of neat Portland cement, six months old, 2 inches thick, and 2¾ inches wide, required 2280 lbs. to pull it asunder.

5. Two pieces of Portland stone, 6 inches square (each 6 inches high too,) cemented together by a thin joint of neat Portland cement (four months old,) were suspended. When 3700 lbs. were in the scale attached to the lower stone, the top stone yielded where the iron clippers held it. Afterwards the square holes for the ends of the clippers were made deeper in another part of the stone, and 4500 lbs. were put into the scale, when the iron hook broke, the joint remaining sound.

From the London Builder, No. 451.

The materials here use being Portland *stone* and Portland cement, it was with difficulty that some of the foreigners present could be made to understand that the latter was not made from the former, and we mention the circumstance as an illustration of the erroneous impressions given by improper appellations. It is the same with Roman cement. A scientific French writer in describing that marvellous piece of construction, the Thames Tunnel, deceived by the name, says that the engineer succeeded here by adopting *the cement of the ancient Romans*, although, as we know very well, the cement in question which really was used had no more to do with the Romans than it had with the Pope.

6. Two pieces of Portland stone, the same size as the last, joined together with Roman cement, five months ago (a thicker joint, by the way, than in the previous case,) required 2780 lbs. (including scale) to separate them,—a much greater weight than was anticipated. The cement left the stone; so that its adhesive power yielded, not its cohesive.

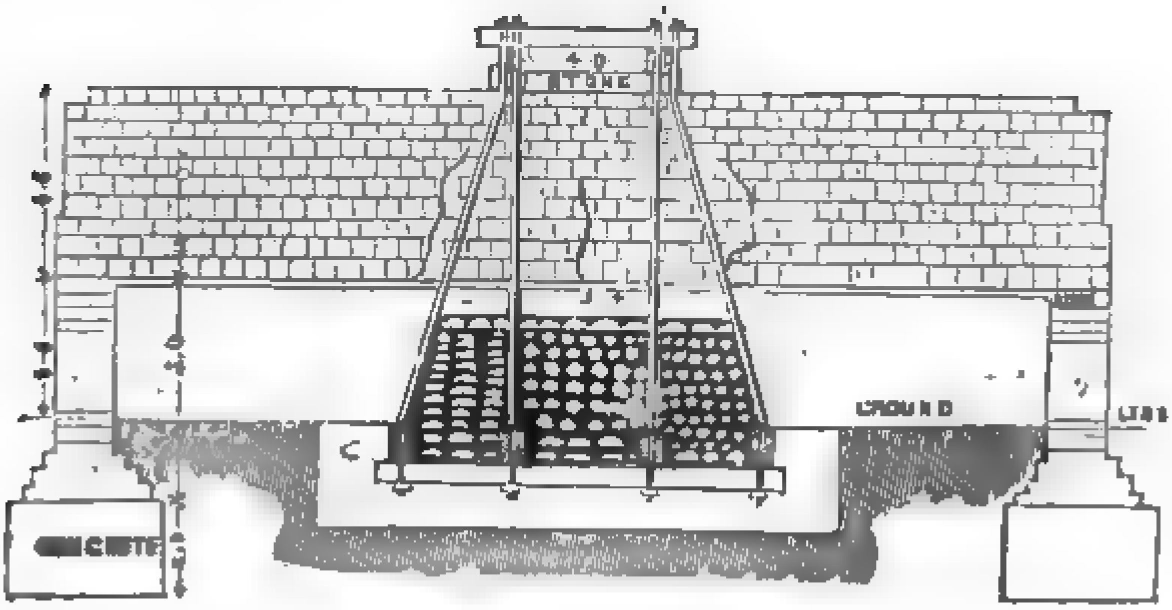
Turning now to the principal example of the series—the hollow brick beam—we annex views of the front and end of it, showing its dimensions and construction, and the mode of applying the weight.

During Saturday the beam was loaded in the central part with 15,000 lbs. weight of pig iron, and in this state it was left until one o'clock on Monday, when it was carefully examined and found quite free from any indication of failure. The loading was then resumed until it was weighted with 40,000 lbs., at which time a deflexion of nearly one-eighth of an inch was observed: with 41,600 lbs. two cracks exhibited themselves in the four lower courses, at a short distance right and left of the centre of the beam, and a crack in the centre of the beam. With 51,600 the cracks extended through the six lower courses and the deflexion increased to five-sixteenths of an inch; with 62,800 lbs., which it bore for a short time, the beam gradually separated into two parts as nearly equal as possible, the line of fracture being vertical and indiscriminately through bricks and joints as they occurred. In falling, the beam thrust the piers considerably out of an upright.

It will be remembered by many that in 1837 an experimental brick beam was (at the suggestion of Mr. Brunel) built by Messrs. Francis and White, at their cement works, Nine Elms, Vauxhall, for the purpose of ascertaining the strength of Roman cement. The beam consisted of hard stock bricks, bonded in the usual way, and bedded and grouted with a mixture in equal portions of the best Roman cement and clean Thames sand, making it completely hollow throughout. It consisted of nineteen courses of bricks, the thirteen uppermost courses being two bricks or 18 inches in thickness, and the six lower courses two-and-a-half bricks, or 1 foot $10\frac{1}{2}$ inches in thickness. The sectional area was, therefore, thirteen courses, at 3 inches each, $=39$ inches $\times$ 18 inches thickness $=702$ inches; six courses, at 3 inches each, $=18$ inches $\times$ $22\frac{1}{2}$ inches thickness $=405$ inches, total sectional area 1107 superficial inches, and in the lower courses were inserted (as we understand) fifteen lengths of hoop-iron, $1\frac{1}{2}$ inch and $\frac{1}{18}$ inch.* The beam was supported at each end, leaving a clear bearing of 21 feet 4 inches, and after it had been built about *three months* it was loaded with 11,200 lbs. of pig-iron, placed on

* General Pasley says, in his work "On Limes," five only, p. 162.

a platform, which was suspended at the central part of the beam, which weight was increased at the end of another three months to 24,000 lbs. In this state it was left for twelve months, at the termination of which period it was determined to load it until it broke down, which was effected by increasing the weight to 50,622 lbs.



DIMENSIONS.

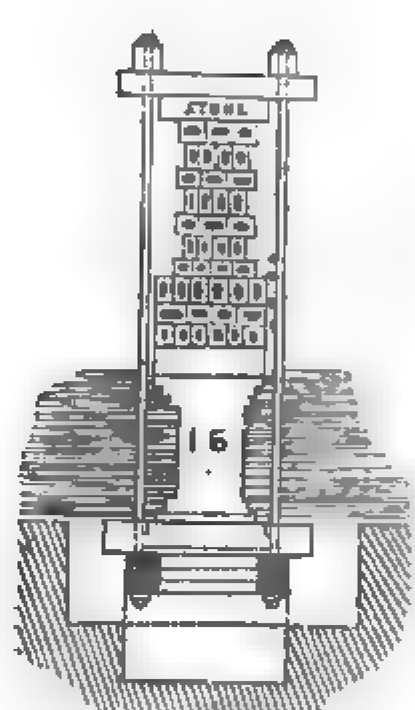
Neat length,	24 ft. 4 in.
" length,	21 ft. 4 in. in clear of piers.
" depth,	4 ft. 6 in.
" thickness,	2 ft. 4 in. bottom, and 1 ft. 6 in. upper part.

Built of equal parts cement and sand; completed, 12th April; centres struck, 22d April.

CONSUMED:

1200 hollow bricks, weight,	10,750 lbs.	
32 bushels cement, 32 ditto sand,	6,400 "	
		17,150
If built in common bricks would require—		
2700 stock bricks, weight,	13,420	
50 bushels cement (Roman,) 50 ditto sand	8,000	21,420
	difference,	4,270
Weight of scale and iron work,	1,792 lbs	
" of stone,	672 "	
" of beam in suspension between piers.	15,00	
		17,464 lbs.
In common bricks:		
Scale and stone, . .	2,464	
Net weight of beam, . .	18,743	21,207 lbs.
	difference,	3,743 lbs.

=1 ton, 13 cwt. 1 qr. 19 lbs.



Messrs. White and sons had determined, *for the purpose of exhibiting the strength of Portland cement as compared with Roman cement*, to erect a brick beam in all respects similar to the last described (except the substitution of *Portland* for *Roman* cement;) but a short time previously to the opening of the Exhibition, it was suggested to them that if they made

use of hollow bricks instead of the ordinary solid bricks, it would add much to the interest of the experiment (as experiments upon hollow bricks were much wanted;) and in compliance with this suggestion, they erected, a few days before the opening of the exhibition, *a beam of hollow or tubular bricks, with Portland cement and sand* (*in equal portions*,) with iron hooping in the lower courses, and generally following, in all respects, the dimensions and form of the beam built with Roman cement at Nine Elms, as far as the use of the hollow bricks would permit. The weight was applied in the central part of a clear bearing of 21 feet 4 inches, in the same manner as to the Roman cement beam. The use of the hollow bricks occasioned some difference in the sectional area, which we have to take into account; but we shall disregard in the present comparison the disadvantages arising from having merely the narrow edges of the tubes to connect with the cement instead of the broad surfaces of ordinary bricks.

The Portland cement beam, as will be seen by the accompanying diagrams, consisted of ten courses; the upper part having three courses on edge, and four flatwise, and the lower part two courses on edge, and one flatwise. The bricks were all laid as stretchers, and the beam consequently consisted of a series of forty tubes (the number of bricks in section throughout,) which were open from end to end of the beam. The average size of the bricks was $5\frac{5}{8}$ inches by $4\frac{1}{8}$ inches, and, the rims or sides being about $\frac{7}{8}$ of an inch in thickness, the tubular or hollow parts were each equal to 9 inches super. But with the joints and beds the whole measured in the six upper courses an average of 36 inches $\times$ 17·52 inches, $=$621 inches; and in the three lower courses an average of 1.05 $\times$ 26·6 inches, $=$439 inches; making a total area of 1060 inches: from this deducting the forty vacuities, or hollow parts, of 9 inches each, $=$636 inches, we have as the net sectional area, 700 inches.

By an inspection of the diagram, it will be seen that as the vacuities are distributed throughout the whole depth of the beam, they occasion a loss of strength nearly proportionate to their whole extent, varying of course as their distances from the neutral axis.

On the part of Messrs. White it is argued that the depth of the Roman cement beam being 57 inches, and the sectional area 1107 inches; and the depth of the Portland beam being $52\frac{1}{2}$ inches, and its net area, 700 inches, we shall have $1107 \times 57 = 63{,}099$; and $700 \times 52\frac{1}{2} = 36{,}750$, as expressions of the relative strength of the two beams, supposing they had been built of the same materials.

The *Roman* cement beam (as before mentioned) was broken down with 50,652 lbs., and since 63,099 : 36,750 : : 50,652 : 29,500, it follows that if the *Portland* cement beam had broken down with 29,500 lbs., the two cements would have exhibited equal strength; but, inasmuch as it took 62,800 lbs. to break down the *Portland* cement beam, the experiment exhibited a superiority of *Portland* cement over *Roman* cement in the ratio of 2·128 to 1, or, in round numbers, $2\frac{1}{8}$ to 1. This reasoning, however, is scarcely correct, since it does not take sufficiently into consideration the strength dependent on *disposition* of the material.

From some experiments made upon Portland and Roman cement, where solid bricks were used with each, the superiority of Portland cement

was found to be much greater than this is shewn by experiment,—but when we consider the nature of the structure, and take into account the circumstance of the *Roman* cement beam having been built *seventeen months* before the breaking weight was applied, whereas the *Portland* cement beam had been only erected *five months*, we are not surprised that the experiment with the hollow bricks did not exhibit the full strength of Portland cement. It is to be regretted that hollow bricks were used, as it would have been better to have rested the comparison upon two beams as strictly analogous as possible, instead of complicating the subject with conditions that are extraneous to the immediate inquiry.*

The important part played by the iron bond in this experiment must not be overlooked. Sir Charles Pasley, in his work on cements, describes two beams constructed by him for the purpose of ascertaining, how much of the extraordinary resistance of brick beams built with cement might be owing to the hoop iron bond. These were precisely similar, with the exception that one of them had five pieces of hoop iron bond, and the other none. The latter cracked when the centering was removed, and was broken by a weight of 498 lbs., while the first sustained a weight of 4523 lbs. before it yielded. "The mutual adhesion of the cement and the iron, says that author, is so perfect, that no force can separate them without producing the complete fracture of the brickwork, which is thus resisted by all the tenacity of the iron."

The tensile strength of wrought iron per square inch of section, may be called 27 tons. The mean of Mr. Telford's experiments gave 29 tons, as did some conducted under our own superintendence. Mr. G. Rennie says 24·93, and Capt. Brown 25 tons.†

In the hollow-brick beam there were fifteen pieces of hoop iron bond, one and a-half inch by one-sixteenth of an inch, nearly; namely: four in the first course, four in the second, three in the third, and two in each of the next.‡ The pieces of iron were all broken, except one in the bottom course, one in the second, and one in the top course.

This very interesting proceeding suggests many observations, but we must now pass on to the experiments, also on Portland cement, which were exhibited on the same occasion by Messrs. Robins and Aspdin, of Scotlandyard.

1. A suspended block of cement, 3⅞ inches wide, and 2⅛ inches thick (one month old,) was pulled asunder by 3240 lbs., including the weight of the scale.

2. Sixteen stock-bricks, attached to each other with neat cement, supported at one end, and projecting from the bearing point 3 feet 2½ inches, broke in the eleventh brick with 256 lbs., exclusive of scale, suspended on the extreme end.

3. A solid step, 6 feet 5 inches long, and 7¼ inches deep at the back, formed of two parts Portland cement and one part broken bricks, held up at one end, carried itself, and broke off close to the bearing-point when the third 56 lbs. weight (168 lbs.) was placed on the extreme end. The weight of the step was called 4½ cwt.

* Hollow bricks are usually better moulded and more thoroughly burnt than ordinary stocks.

† Eight or nine tons may be considered a safe load-strength.

‡ In the diagram, by mistake, only *fourteen* are shown.

4. Two blocks of neat cement, 1 foot 5½ inches long, 9 inches wide, 4½ thick, cemented together with neat cement, bore 6000 lbs., when the lower part of the lower block gave way.

5. Twenty stock-bricks, united side by side with cement, composed of one of cement and one of sand, 3 feet 6½ inches in bearing, were supported at each end by iron clamps; the weights being applied to the centre, the bricks broke with 1200 lbs.

6. Six fire-bricks, in courses, cemented together with pure cement, were suspended, and weights were applied to pull them apart; the upper brick broke with 2836 lbs. in the scale.

7. The five fire-bricks from the last trial were again tested, iron being inserted in the second brick from each end; the upper brick broke, carrying away also part of the lower, with weight of 4600 lbs.

8. Two pieces of Portland stone, 2 feet by 11½ inches, 7¾ inches thick, cemented together with neat cement, took a weight of 7272 lbs.; when the lower stone yielded, carrying away a small portion of the cement joint.

Our readers will find other experiments on the same material, both by Messrs. White & Sons, and Messrs. Robins and Aspdin, in our sixth volume, pp. 343, 351, and 471.

For the Journal of the Franklin Institute.

Note on the Tow Boat "America," and her Trial Trip.

A new steam tug, under the above name, has recently been placed upon the Delaware river, by the "Philadelphia Steam Pump and Towing Company," and was tried Dec. 8th, 1851. Her dimensions are, length (between perpendiculars) 133 feet; extreme breadth, 25 feet; depth of hold, 13 feet. She is rigged with two masts, with fore and aft sails to be used in case of accident to her machinery; and is propelled by two vertical direct action trunk engines, with cylinders, having each an effective area equal to 32 inches diameter, and 30 inches stroke, attached to a propeller (true screw) 10 feet in diameter, 26 feet pitch; angle of blades at periphery with a line perpendicular to the axis, 39° 30′; total absolute surface of blades, 61·30 square feet. She has one boiler, of the description known as the Horizontal Return Tubular, having large flues below and tubes above. The fire room is forward.

Her performance on the trial was as follows:

From Navy Yard shears to Chester wharf, 1 h. 53 m. 23 sec., against flood tide; average pressure of steam in boilers, 26¼ pounds; at steam chests, 25¼; average vacuum, 26 inches; revolutions made, 5501; average per minute, 48·5; distance, 16·25 miles; speed per hour, 8·6 miles. During this part of the trip, the "thrust" journal of the propeller shaft gave trouble by heating, reducing the number of revolutions. On the up trip, time from Chester wharf to Navy Yard shears, 1 h. 14 m. 57 sec; steam and vacuum about the same as before. Revolutions made, 3822, or 50·95 per minute. Average speed, 13 miles per hour; tide, flood, as before, and therefore in favor. To find the slip, the velocity of tide must be ascertained

as follows: had the journals not heated going down, 50·95 revolutions would have been made, increasing the speed to 9·04 miles per hour.

Speed coming up was, . .	13	"
Difference	3·96	
Or, average speed of tide per hour,	1·98 miles.	

This speed, therefore, on the down trip, acting for 1 h. 53⅓ m. increased the distance run by . . . . miles 3·740
On the up trip, acting 1 h. 15 m., diminished the distance run by 2·475

Whole increase of distance,	1·265
Distance performed (by shore marks,) . .	32·500
Space absolutely passed over, miles	33·765

$$\text{Then } \frac{33{\cdot}765 \times 5280}{93223 \times 26} = \frac{178280 \text{ feet}}{242408} = 73{\cdot}54$$

and 100—73·54=26·46 per cent. mean slip of the propeller. The vessel was drawing 12 feet aft, and 9 feet forward, at the time of the trial.

The performance of the engines was very good, and their workmanship and appearance highly creditable to the makers, James T. Sutton & Co.; the hull was constructed by Vaughn & Lynn.

Note.—On the above trial the brass packing around the trunks became constantly very dry and required great attention. This brass packing has since been replaced by hemp, and (it is stated,) the change has resulted in a gain of 4 to 5 more revolutions over the number obtained on the trial. M.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, December 18, 1851.

S. V. Merrick, President, in the chair.
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A Letter was read from Mrs. E. Taylor, informing the Institute that the Collections of Minerals, Scientific Books, and Instruments of her late husband, R. C. Taylor, Esquire, will be held at private sale at No. 48, South Fourth street.

Donations were received from The Royal Astronomical Society, London; The Baltimore and Ohio Railroad Company, Baltimore, Md.; The Chicago Mechanics' Institute, Illinois; The Hon. T. M. Bibighaus and Joseph R. Chandler, Members of Congress; and H. Carey Baird, Charles E. Smith, and Isaac Lea, Esq.'s, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for the month of November was read.

The Board of Managers and Standing Committees reported their minutes.

The Special Committee appointed at the last meeting, respecting the publication by Messrs. Yerger & Ord, of the Report of the Committee of Judges on Surgical Instruments at the late Exhibition, presented and read their report, in which they recommended the following resolution, which was on motion adopted:

Resolved, That the Actuary be directed to announce through the public papers, that no action has been had by the Committee on Exhibitions nor by the Institute, on so much of the report of the Judges on Surgical Instruments, at the late Exhibition, as relates to Artificial Legs and Club Foot Apparatus; and that the publication thereof made by Messrs. Yerger & Ord, is without authority or consent of the Institute, or the Committee on Exhibitions.

Resignations of membership in the Institute (5) were read and accepted.

New candidates for membership in the Institute (21) were proposed, and the candidates (97) proposed at the last meeting were duly elected.

Nominations were made for Officers, Managers, and Auditors of the Institute for the ensuing year.

On motion, it was resolved that the election for Officers, Managers, and Auditors of the Institute for the ensuing year, be held on Thursday, January 15th next, between the hours of 2 and 8 o'clock, P. M., and that seven members be appointed to conduct the election.

Dr. Rand exhibited to the members a new gas burner, which possesses the advantage of great steadiness of light, being the only one yet found sufficiently steady for microscopic purposes, and comparing in this respect with the Carcel lamp. It is a modification of the burner known as the "patent burner," and is the contrivance of Dr. P. B. Goddard, of this city, well known for his accuracy as a microscopist. It consists of the patent burner of the medium size, having the button attached to the central tongue sawn off at the level of the holes, for the admission of the gas, and the outer row of holes for the admission of air stopped up, a cylindrical chimney being used. He also presented one having the outer row of holes left open, which was found on trial to give an equally steady light. Dr. Rand mentioned that he had, with Mr. G. W. Smith and Dr. C. M. Cresson, ascertained the economic value of this burner, by Ritchie's photometer, and gave the result as follows: The two burners were compared with a fish-tail burning 5·7 cubic feet per hour. Its value, as calculated and compared with a standard candle, was 14, that of Dr. Goddard's burner 9·1, and that of the second form of burner 10·4. Thus showing that, as far as the experiments went, the steadiness of the light is at the expense of economy, a result he believed accordant with the general rule in regard to all gas burners. He further remarked, that as the fish-tail was a large one, the result might appear rather too marked against the modified burners, inasmuch as he believed it to be true that the relative economy of bat-wing or fish-tail burners increases in a rapid ratio with their size. The experiments with these and other new burners will be further prosecuted.

Prof. Frazer said he believed that not only did candles of the same ze and material burn unequally, but that the same candle burns with ifferent rapidity and amount of light at different times. He had found in is class experiments, that two similar candles lighted at the same time 'ould alternately burn above or below an average line.

Prof. J. C. Cresson, in reply to inquiries, remarked in relation to the andard candle, although it might be true that all spermaceti candles six the pound did not burn equably, yet it had been convenient to assume iat size as a standard. It was also true, that as we reached the maximum f economy in a burner, we rendered the flame more liable to be influnced by slight changes in the supply of air or gas, and thus unsteady. le explained the greater relative economy of large bat-wing and fish-tail urners by the fact, that as the size increases the sheet of gas becomes iicker, and less gas is burned before decomposition.

Prof. Frazer stated that he had found the double cut burner advanigeous, as it gave a good, strong light when burned comparatively low, nd an economical light at the full head of the gas. He further remarked iat this double cut burner was not new, as had recently been claimed.

Dr. Rand further exhibited some oil of resin, distilled by the Pennsylania Oil Company, at Port Richmond. This Company recently comienced the manufacture of oils from resin, under the patent of Louis S. lobbins, issued November 4, 1851, and they are now manufacturing achinery, paint, and tanner's oil. These are made by the same process s those of the New York Company at Brooklyn. The specimen presentd was intended as a lubricating oil, and is represented by the manufacurers to possess decided advantages over any other oil now in use for his purpose. It is also represented as not liable to congeal, or to inflame rith cotton.

Mr. G. W. Smith drew the attention of the meeting to the subaqueous method of removing rocks at Hell-gate and other places in the harbor of New York, under the direction of M. Maillefert, by the direct application of canisters of powder to the surface of the rock, without the intervention of drilled holes, although the latter had in a few instances been resorted to. Mr. S. alluded to the previous efforts in subaqueous blasting, made in Europe and elsewhere, and described the great waste of force in the method of M. Maillefert, stating that the whole force expended in elevating the water to a vast height in the air was wasted, and that the method never should be resorted to where drilling was at all practicable, and deprecated the proposed introduction of a method, moreover not new in itself, to the blasting of rocks in the Delaware and Schuylkill rivers.

Mr. G. W. Smith presented the statistics of all the Coal mined in the State of Pennsylvania, both bituminous and anthracite, including not only the amount sent to market, but also the local consumption by families, by manufacturing establishments in the coal regions, &c. The amount of anthracite is nearly 4,900,000 tons for the present year, 1851, and of bituminous nearly 2,400,000 tons. The data as to the latter he stated would require some revision, and the total statement of the amount will appear in a subsequent number of the Journal. Mr. S. begged the meeting to consider that the *production* of coal in Pennsylvania was nearly three tons for every man, woman, and *child of* the whole population of

the State; while in the British Islands the production was only about one ton for each inhabitant. The domestic consumption and exportation being included in both cases, the consumption, however, per individual is of course much greater in Great Britain, where they are wholly dependent on this fuel, as is well known.

BIBLIOGRAPHICAL NOTICE.

Appletons' Dictionary of Machines, Mechanics, Engine Work, &c.

In the December number of *Appletons' Magazine* there is a reply to our comments upon the omission of Mr. Byrne's name from the title pages of the Encyclopedia which he wrote for the Messrs. Appleton. The following is the substance of the article:—

> In the month of June, 1850, we were invited by the Messrs. Appleton to take the entire charge of the editorial department of their great Dictionary, then in progress, and published as far as the letter F. Mr. Byrne (whom we have never met) ceased to have any control over the work after this date, and we commenced our editorial duties with the letter G, and after sixteen months labor brought it to completion.
>
> That our own name did not appear on the covers of the work as it issued from the press was entirely owing to the circumstance that as the Dictionary had then a large circulation, and known as Byrne's Dictionary of Machines, &c., the publishers, for obvious reasons, did not think they were called upon to publish the fact of a change in the editorial department, but finally withdrew Mr. Byrne's name from the cover of the numbers; and at *our own* instance substituted their own in its place. There being a manifest impropriety in issuing to the public, as edited by a gentleman, a volume with which he had no connexion, will sufficiently account for Mr. Byrne's name not being inserted in the *Second* volume, however he might have been entitled to that consideration in the First. We were not ambitious of having edited *half* a book—hence, declined the honor of appearing on the vacated title page of this same volume; and if the Messrs. Appleton saw fit to publish their Dictionary without acknowledging the editorial labor expended upon it, no one should complain so long as *we* were content.

We have received a note from Mr. Byrne, containing the following assertions: "I am the compiler and editor of the Dictionary of Machines, &c., &c., from A to Z." "I selected, superintended, *wrote* and collected, collated, compared, examined, and prepared the work for publication." Mr. B. also submitted to our inspection copies of his agreements with the Messrs. A., in which he is spoken of both as the editor and the author; also a copy of a subsequent memorandum, dated May, 1850, in which some especial arrangements as to payments, &c., are agreed on. Now our proposition is simply this,—If Mr. Byrne did write and compile the entire work he was entitled to the credit of it, and it was wrong to take his name off the title page. If Mr. Byrne did, as he alleges, prepare the whole work for publication, his case is still stronger. But there is another point to which we would call the attention of the editor of *Appletons' Magazine*. If "the manifest impropriety in issuing to the public, as edited by a gentleman, a volume with which he had no connexion, will sufficiently account for Mr. Byrne's name not being inserted in the second volume," how comes it that the original title page of the second volume has his name on it, and was afterwards cancelled, and the one without it substituted? F.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

FEBRUARY, 1852.

CIVIL ENGINEERING.

*Extract from the Report of the General Board of Health respecting the Metropolis.—Water Supply and Drainage of Towns.**

Continued from page 6.

Professor Way was asked: "For the collection of the rain-fall of a given district, what soil would you prefer?" "I should say, decidedly, a sand. Rain-water, when collected at a distance from towns, is fit for every purpose. All that is required from the collecting surface in this case is, that it shall perform its office without imparting to the water anything to render it impure. Sands which have been washed by rain for ages are most likely to fulfil this condition, and would possess the further advantage of allowing the ready escape and collection of the water."

Specimens of surface-water collected at various points in districts surrounding London were examined; amongst these was a specimen from the Ruislip Reservoir, the water from which is used for feeding the Grand Junction Canal; this water is from the surface-drainage of a tract of clay land, and "gives 8 degrees of hardness, or just one-half the impurity from lime of all the rest of the Company's specimens put together."

The searches made south-west of the metropolis appear, however, from the nature of the strata, to be attended with the greatest promise of success. The evidence of Mr. Donaldson is given at length respecting Richmond Park as a gathering-ground, as "this one plot of land is illustrative of the principle of improved supplies." The soil of that park "is a sandy or gravelly loam, incumbent on a clay subsoil." The water drained from it was "perfectly clear, soft to the feeling, well aërated, and pleasant to

* From the London Mechanic's Magazine, for September, 1851.

drink." Mr. Donaldson said, in his evidence, "I am, from long observation, aware that water passing through a bed of vegetation does leave behind, not only the matter in mechanical suspension, but much of the matter in chemical solution. This is a point which has not hitherto received the attention which its importance deserves. I am quite sure that a bed of vegetation will detain for its food saline and other matter in solution, which no sand or other artificial filter will separate from the water. I have seen water containing a considerable quantity of sewage from a farm-yard, which has passed upon well-drained pasture land, and the water which has drained through it, has come out perfectly clear from the manure in solution."

"It is to be presumed, however, that there might be an extent of manuring, or shallowness of the filter bed of earth, which would *not* detain the matter in solution? No doubt of it." Animalculæ have never been met with by Mr. Donaldson in shallow spring-water as it came from the spring or drain.

The ordinary rain-fall at Richmond Park is estimated at 25 inches; the usual calculation of the quantity of water collected from rain-fall is the third of the amount of fall.

The Board has in review various sites in the vicinity of the metropolis which might be applicable as gathering-grounds, but give a preference to the tract "commencingwith Bagshot and Woking sands, and extending to Hampshire." Farnham has been for some time supplied with soft water by the drainage of less than two acres of the common land. The water "is delivered clear and limpid at all times of the year." "There is no reason why the same quantity of water should not be obtained from the whole of a tract of waste land there, ten miles long and five broad." "The improvement of most of these tracts has hitherto been given up in despair, and the growth of fir is recommended as the only agricultural purpose for which they are fitted." The Bagshot sands are estimated as covering an area of 300 square miles. "Beneath these sands is a retentive stratum of marl and clay, varying from five to fifteen or twenty feet in thickness."

"The portion of this district to which our attention has been more immediately directed, comprises an area of no less than 100 square miles, lying east and west of a line from Bagshot to Farnham." "Waters collected in this district at the surface, immediately after rain-fall, are of the highest degree of purity, being in large quantities not exceeding one degree of hardness."

"The chief practical result deducible from these observations is, that by arrangements for collecting the water before it has traversed any great extent of surface, a quantity sufficient, as it appears, for the domestic supply of the whole metropolis will be obtainable at a very high degree of purity, probably equal to the present supply of Farnham."

"The nature of the source requires a preservation of the rain during periods of its maximum fall, for a regulation of the supply during periods of a minimum fall. The storage-room must therefore be very extensive. The primary engineering disadvantages of this district are, that it presents no deep natural hollows, such as are available to many of the northern towns, for the storage of water without extensive excavations. Here the excavations for storage reservoirs must be very large and extensive.

Against the modern engineering practice of exposed and open reservoirs, we would rather revert to the custom of the Roman engineers, and recommend covering the service reservoirs and aqueducts to the utmost extent practicable."

"As a foundation for proximate estimates, plans have been got out by our engineering inspectors for extensive covered reservoirs, and for the conveyance of the water in deep conduits, also covered. They estimate the total expense of storing and bringing to the metropolis this new and improved supply, inclusive of reasonable compensation for waste land for reservoirs, at little more than one million sterling. We fully believe that two years' saving from the use of the purer water, would fully repay this portion of the outlay."

The Board evidently give a preference to the obtainment of water from suitable gathering-grounds, which, on account of its softness and purity, they consider as superior to that from the sources of supply indicated by Captain Veitch. This gentleman's evidence is, however, given at length in Appendix, No. 2. It appears by that evidence that he indicated several different available sources of supply, and he recommended them on account of their perennial abundance, "considering that the population of the metropolis has nearly doubled itself in 45 years," "and that great solicitude is entertained lest the same rate of increase may continue to 1890, I consider it a most important measure to secure all the best supplies of water that can be obtained near London, before they be appropriated to other objects of minor importance." The sources particularly adverted to are as follows: those at Hertford, where "there is a singular meeting of four copious streams of water proceeding from chalk valleys, viz: the Lea, the Verulam, the Beane, and the Rib, which jointly have a discharge of 9,360,000 cubic feet per diem;" "the Ash, the Stort, and springs which join the river Lea below Ware, about 4320 cubic feet of water per day. Such are the resources of the river Lea and its tributaries, and which for the paramount object of supplying the increasing population of the metropolis with so needful an element of health and consumption ought to be held sacred for that purpose alone." The conjoint waters of the river Lea, at Field's Weir, "amount to fourteen millions and a half of cubic feet, or ninety-four and a quarter millions of gallons per day." In respect to other sources, Captain Veitch said, "I conceive, in the first place, that the water of the river Verulam is the first to be secured, and rendered available for the public good at London; the water of this river taken a little above Watford, is a never-failing stream, derived from springs, and yielding three millions of cubic feet of water per diem, at an altitude of 158 feet above high water in the Thames." "Similar to the supplies of water on the north-east of London, which unite to constitute the river Lea, those on the north-west of London unite to constitute the river Colne, and consist of the following streams: The Colne proper, an insignificant brook in dry weather:" The "Verulam, a fine stream," is chiefly fed from springs, and is clear and constant, with an average yield of about 3,000,000 cubic feet per diem: The Gade, chiefly fed by springs, yields a supply of about 4,000,000 cubic feet per diem: The Chess, a lime stream fed by springs, 2,000,000 feet per diem. The above streams

have their water united a little way above Rickmansworth." The river Mole is only noticed as a probable source that may be available.

For the supply of water to the south side of the Thames, Captain Veitch had "especially directed his attention to the waters of the river Darenth," which yield about 2,600,000 cubic feet per diem." "The waters above specified," may all be delivered to reservoirs, 140 feet above high water mark. Captain Veitch was asked, "Do you not consider the above quantity of water as unnecessarily great? If water can be brought to London from such short distances, and at such an altitude on the gravitation system alone, cool and clear in quality, I do not consider that any quantity of such water, and under such conditions, can be deemed over abundant for the health of the population." The supply of water to Rome, under the Empire, "by the Roman aqueducts, amounted to about 50,000,000 cubic feet per day, for the use of a population presumed to have consisted of about 1,000,000." The population of London is now about two millions and a quarter; Captain Veitch conceives that forty years hence it may be increased to 4,000,000 of souls.

A statement of *all* the schemes that have been proposed for the supply of water to the metropolis has been drawn up by Mr. Henry Austin, and is published in the Appendix, No. 2, of the Board's Report; but as they are all of them variations only of the principal schemes, following up the Board's recommendation of gathering grounds, or deep wells, or Captain Veitch's, to take advantage of existing springs and streams, it seems superfluous in this abstract to enter into particulars of these minor schemes.

As to deep wells, it is abundantly proved that they could not afford a sufficient supply. Whether to prefer the collecting of water from gathering grounds, preserving it pure in covered reservoirs, or whether the bringing water impregnated with lime from streams affording a perennial supply, and providing for the purification from lime of the water before delivery, seems mainly a question of pounds, shillings, and pence. The greatest expense attendant on the former mode seems to arise from the immensity of reservoir required—that reservoir necessarily a *covered* one; for it is admitted, that in an *open* reservoir the water would become even more contaminated with organic impurities, animal and vegetable, than it is found to be even in the Thames. These reservoirs would have to provide not only for a sufficient supply during the dry weather of ordinary summers, but also for seasons of extraordinary drought; the leaving London so much as a single day without water, is too horrible a chance to be risked. There are some seasons when, for perhaps two months, there is no material rain-fall. How many acres of covered reservoir would suffice for the supply of London during such a drought? It is easy of calculation; so is the expense of depriving water of lime, which would be to be compared with the cost of covered reservoirs. The depriving water of carbonate of lime, by Professor Clark's process, might perhaps suffice—further purifying it in Mr. Holland's mode would add to the expense; but even that is compensated for, according to his evidence, by enabling thus the water to save soap in washing, and to require less tea, &c., in making extracts.

Should the gathering ground system be adopted, Professor Way's experiments, in addition to experience at Farnham, and to general agricul-

tural and other observations, indicate that the gathering grounds should be under the complete control of whatever person or persons may have to govern the supply of water to London; this would be essential, since those grounds should at all times be kept at a certain degree of vegetable production; enough of that growth to assimilate the whole of whatever adventitious manure might fall upon the grounds, as also any moderate quantity that might be permitted for the purpose of profitable cultivation of the area chosen as a gathering ground.

The properties desirable in water itself having been thus exhibited, and the sources from which a supply may be obtained, the next consideration is that of the most efficient and most economical mode of bringing water to the metropolis, and of distributing it therein with the greatest convenience and at the smallest cost to the inhabitants.

The General Board of Health are of opinion, that "even if the same sources of supply as those taken for the New River were eligible, and if those works belonged to the public, they ought to be abandoned, and the Roman principle of covered channels reverted to, as Captain Veitch proposes."

Captain Veitch, in his evidence, gave many particulars, showing that the mode originally adopted for the conduction of the New River was defective, on account of its being an open canal, following all the sinuosities of the ground, as on a contour line; that it had an inclination of only three inches per mile, but that "within the present century great ingenuity and great expense have been applied by the New River Company to correct the evils of the rude and vicious mode of conduit first adopted." He observed, that "a great objection to the conveyance of water for domestic purposes, in an open earthen channel, is, that the water must have a very slow motion, not exceeding half a mile per hour, to prevent the current wearing the channel-bed, and bringing in turbid water; the slow motion is again attended with serious evils, depositions of silt and decayed vegetable matter take place, which require to be cleaned out from time to time; in the warm season, so long and broad a surface exposed to the atmosphere gets heated to a degree favorable to the production of vegetable and animal life of the lower forms, and also in giving rise to a considerable quantity of waste from evaporation; the high temperature of the water rather facilitates the decoction of leaves and other vegetable matters, which get blown into the New River, to the manifest injury of the water; but there are other pollutions of a worse character, to which all open canals are subject. It is true, the New River Company have five acres of settling-grounds at Clerkenwell,* and thirty-eight at Newington, for the deposit of solid matters." "Such are the objections to all open water conduits conducted in earthen channels, the deficiencies of which will, however, be still better appreciated by a contrast with the qualifications that may be obtained for the same water, if conveyed in

* Dead dogs and cats are strained off by a grating before the water enters the settling ground at the New River Head, but other impurities cannot be so separated. A panic has sometimes been occasioned by a report that the New River was poisoned, as it happened during the excitement occasioned by Lord George Gordon's riots; all the water was then for a short time red; this, on examination, was found to have arisen from a quantity of refuse madder, thrown in from a dye-house.

covered channels constructed of stone or brickwork, and conducted in straight lines, with an uniform and efficient descent, crossing valleys on embankments or arcades, and piercing hills, by tunnels or adits; for example, the water of the river Lea might be conducted to London in such a channel from Ware, at a distance of 20 miles, instead of forty, and with a speed of one mile per hour, instead of half a mile; that is, the transit would be accomplished in twenty hours instead of eighty."

Mr. Rawlinson, in giving an account of the Croton aqueduct, instanced it as serving both as a warning and an example. The aqueduct itself has cost upwards of 40,000*l.* a mile, exclusively of reservoirs; it is supported upon a solid foundation wall, 17 feet thick; the "true aqueduct or water-way is constructed with a brick lining upon a concrete foundation." The whole structure is banked up with earth on each side. "It would be difficult to devise a more expensive work." "Nevertheless, in several instances, it has been found necessary to line the water-way with iron."

Mr. Rawlinson is of opinion that "iron, wrought and cast, may be much more extensively employed in water-works than has hitherto been the practice." "Where it is not thought advisable to cross a valley or river by an inverted syphon-pipe, an elevated wrought iron tube aqueduct may be constructed, light, elegant, nay, even graceful in structure." "Telford set an example in his celebrated Pont-y-Cypoylte aqueduct, which is 126 feet in height, 1007 feet in length, and has a cast iron water-way as sound and perfect now as the day it was made."

Mr. Rawlinson himself, in 1846, proposed a plan to the Corporation of Liverpool to bring in a supply of water from the river Dee. "The several intermediate valleys would have been crossed by inverted syphons, or by means of elevated aqueducts of wrought iron." His proposal was submitted to Mr. Fairbairn, who in his report to the Chairman of the Liverpool Water-works Committee, October, 1846, said that "tubes 6 feet deep and 2 feet wide, with close tops, can be made of sufficient strength to carry 33 tons of water on 100 feet span." "The weight of 100 feet of such a tube will be about 12½ tons."

In respect to durability, "care must be taken to prevent oxidation, and in order to do this effectually, it will be necessary to make the top of the tubes, as all the other parts, perfectly water-tight, and the tube being always full of water, it will be a great security against corrosive action in the interior. On the outside the usual preservatives must be applied; with these precautions, the tube might last for an almost indefinite period of time."

"The effects of winter, or the change of temperature, will not be severely felt on a long and somewhat flexible tube. Internally the temperature will not vary considerably, as it never can be above 60°, and never lower than 32°."

Thus it seems that Mr. Fairbairn is in favor of iron tubes.

Mr. Rawlinson appears to advocate economy in public works. He said that "If modern science has taught us how to make a steam engine, it has not yet fully inculcated the necessity there is that rigid economy should be studied in all engineering works." He gives the aqueduct of Spoletto as an example of the small quantity of masonry that suffices for

piers. "The middle arch of that structure is 328 feet in clear height, supported on piers 10 feet 6 inches thick." The Pont du Gard, near Nismes, France, might also have been noticed for the small quantity of masonry in its piers; in this instance they have occasionally to resist the immense force with which the waters of the Gardon come down suddenly upon the piers after storms in the mountains, converting a shallow brook into an impetuous broad river.

The mode of execution the Board prefers is not indicated in their Report; but it is said that, from proximate plans and estimates, "got out by our engineering inspectors for extensive covered reservoirs, and for the conveyance of the water in deep conduits, also covered," they estimate the "total expense of storing and bringing to the metropolis this new and improved supply, inclusive of reasonable compensation for waste land for the reservoirs, at little more than one million sterling." The Board, in their twenty-fifth question to Mr. Stirrat, of Paisley, said—"We find at present we can cover a reservoir at about 1000*l.* an acre." Mr. Stirrat had previously observed that, "as to covering or roofing the *storage* reservoirs, that is altogether unnecessary, as nothing of the kind" (the growth of vegetation and production of animal life) "affects us in so *deep* water." So, in other evidence, it is intimated that where waters are *deep*, the evils in question do not exist. As to loss by evaporation in uncovered reservoirs, Mr. Stirrat said—"It is a great mistake to imagine that evaporation takes place to any extent, even in the height of summer, from the surface of a reservoir, where the water is of any considerable depth. The deposit of dew, I think, counterbalances it. I have one pond 10 feet deep, on which I made the experiment, and found, in the heat of summer, that in two months it did not go down one-sixteenth part of an inch; and there might have been a small escape to account for even that diminution."

Whether on *political* grounds the water-supply of London should be from one single source, or from many different sources, does not seem to have been adverted to by the Board itself, or by any of their witnesses; nor, though the water were derived all of it from one and the same source, whether it might not be expedient to convey it to town in two or more conduits, rather than by a single aqueduct. That an army of foreign invaders would easily find its way to London, and burn it, is not to be feared; but that attempts to so destroy it, should be made by its own populace, experience has proved, and that in furtherance of this scheme cutting off the water was designed. Had Lord George Gordon's riots lasted another day, the mains at the New River-head would, it was dreaded, have been cut off, though such troops as could be spared were ordered for the protection of those works. It should not be lost sight of that, in all metropolitan disturbances, a great portion of the rioters is made up of those whose object is plunder, and that plunder is facilitated by extensive conflagration. In that fearful night, when his Lordship's mob had the upper hand, no less than fourteen separate fires were counted from one house-top; and then it was that the abundant supply of water saved the town. Of late, too, when setting fire to houses was one of the projects in an intended insurrection, the water would doubtless have been cut off.

On such accounts, this political question in regard to water-supply seems well worth consideration; and it will be hereafter shown by what arrangements water might be conveyed to every part of the town, though all but a single conduit were destroyed. M. S. B.

---

*Experiments on the Strength of Wrought or Rolled Iron Joists.**

Messrs. Fox and Barrett have just introduced rolled iron joists as a substitute for cast iron in the construction of their fire proof floors, designed with a view to bring the expense to the same as those of cast iron, and thus render fire proof construction with joists of *wrought iron* as inexpensive, according to their statement, as the ordinary timber floors.

On the 25th November, some experiments were made on joists of two sizes, at the Baths and Wash Houses which are now being erected for the parish of St. James, in Dufour's Place, Poland Street. The weight was applied through a lever. The following particulars have been furnished to us.

The smaller of the two joists was 5¼ inches deep, and ⅜-in. thick, with flanch top and bottom, 1¾ inches wide.

Length of joists, ... 17 feet.
Width of bearing, ... 16 "
Weight per foot run, 10 3-5 lbs.

Load on Centre.	Deflexion.	Weight per sq. ft. of floor which the load is equivalent to.
12 cwt.	·65	112 lb. per foot.
15	·80	140 "
18	1·00	168† "
28	1·45	260‡ "

The larger joist was 7 inches deep, and $\frac{7}{16}$-in. thick, with flanch top and bottom, 2¼ inches wide.

Length of joist, ... 17 feet.
Width of bearing, ... 16 "
Weight per foot run, 16¼ lbs.

Load on Centre.	Deflexion.	Weight per sq. ft. of floor which the load is equivalent to.
12 cwt.	·42	112 lb. per foot.
28	·785	260 "
32	·90	300† "
40	1·10	370§ "

AMERICAN PATENTS.

List of American Patents which issued from December 9, 1851, to January 6, 1852 (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

21. For an *Improved Revolving Reverberatory Furnace;* Ambrose S. Beadleston, Au Sable Forks, New York, December 9.

Claim.—"What I claim as my invention is, the rolling or revolving furnace revolving on friction wheels or rollers, or their equivalent, in combination with an ordinary fire, such as is used in reverberatory furnaces, the two being combined in such a manner that the

* From the London Builder, No. 460.
† Up to this point the elasticity of the metal was uninjured.
‡ Permanent set on removal of load, ·075. A load of 18 cwt. on the centre was left on 18 hours, but produced scarcely any perceptible difference.
§ Permanent set on removal of load, ·062.

products of combustion, heated gases, etc., from the grate, shall pass into the interior of said rolling or revolving furnace, substantially as herein described; said rolling or revolving furnace being applicable to any purpose for which ordinary reverberatory or wind furnaces are employed."

---

22. For an *Improvement in Potato Diggers;* Daniel D. Bell, Wawarsing, New York, December 9.

Claim.—"What I claim as of my own invention is, the arrangement and combination of the cutting and digging cylinders with the riddles, in the manner herein set forth."

---

23. For an *Improvement in the Construction of Sounding Boards for Musical Instruments;* Cornelius Bogart, Charlestown, Massachusetts, December 9.

Claim.—"What I claim as my invention is, the above described mode of constructing the sounding boards of stringed instruments, by combining or arranging together, any suitable number of pieces of wood, prepared as above, all in manner and for purpose as herein set forth."

---

24. For an *Improvement in Carbonic Acid Gas Engine;* John C. fr. Salomon, Cincinnati, Ohio, December 9.

"The nature of my invention consists in a new and useful mode of application of liquified carbonic acid gas, as a thermo-mechanic motor."

Claim.—"I do not claim the invention of carbonic acid gas in its liquified or aeriform character, as a motive power; neither do I claim the use of the hydrostatic press for liquifying the gas, as these principles have long been known and commented upon by Sir Hy, Davy, Faraday, Brunel, and others: but what I claim as my invention is, 1st, a carbonic acid gas engine, in which said fluid passes, from a reservoir where it exists in a liquid state, through suitable valves into a heated cylinder; thence into a refrigerator, where it is cooled, and thence through pumps, where it is condensed by hydrostatic pressure, and forced back again to the reservoir before named; the said engine being constructed substantially as herein described.

"2d, The combination of crimped leather washers, a spiral spring, or springs, and oil, or any lubricant, for packing the piston rods or plungers, as described."

---

25. For an *Improvement in Gas Regulators;* Jotham S. Conant, Lowell, Massachusetts, December 9.

"The nature of my invention consists in interposing between the gas pipe from the gas works, and the main gas pipe in a dwelling, or other building, where gas is consumed, a small gasometer combined with a regulating valve, in such a manner, that the pressure of the gas in the pipe within said dwelling or other building, can be adjusted to any degree of pressure, and will remain at precisely the same amount of pressure, whether a large or a small number of burners be supplied by the said pipe."

Claim.—"What I claim as my invention is, the closing of the valve when the fluid becomes too low in the gas regulator, for safety, by the movement of the float and the lever, and their action upon the thimble on the valve rod, substantially as herein set forth."

---

26. For *Improvements in Water Metres;* John Ericsson, City of New York, December 9.

Claim.—"What I claim as my invention is, 1st, The uniform circular channel *a a*, in combination with the contracted channel *b*.

"2d, I claim the rotating paddle wheel, having paddles projecting into and working in the said uniform and contracted channels.

"3d, I claim the apertures *m* and *n*, proportioned and formed as described.

"4th, I claim the pipe *g*, with its jet *r*, for giving motion to the paddle wheel before the fluid enters through the aperture *m*.

"5th, I claim the valve *k*, by which any desirable power of jet may be obtained, before any fluid enters through *m*."

27. For an *Improvement in Chucks for Lathes;* Joseph Hyde, Troy, New York, Assignor to Thos. J. Eddy, Waterford, New York, December 9.

Claim.—"Having thus described my improved chuck, what I claim therein as new is, the mechanism herein described, or the equivalent thereof, for connecting and disconnecting, at will, the whole or any part of the screws which operate the griping jaws, with the wheel which turns them, so that the screws and jaws may be moved either separately or in connexion, or in part separate and in part connected, whereby objects of either regular or irregular shape may be chucked, either eccentrically or concentrically with the axis of the mandrel, substantially as herein described.

"I also claim the turning plate (I) of the chuck, constructed with a cog wheel on its inner face, made in segments, part of which can be withdrawn out of gear with the pinions on the carrier screws, or held in gear therewith by means of set screws and springs, or the equivalent thereof, substantially as herein set forth."

---

28. For an *Improvement in Feeding Logs in Saw Mills;* Charles Ketcham, Penn Yan, New York, December 9.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, the combination of any number of adjustable rollers, which may be set at any angle with the feed rollers, or with each other, for the purpose of feeding up the log, so that it may be cut with the curve or grain of the wood, substantially in the manner as herein set forth and described."

---

29. For an *Improved Arrangement of Pans for Washing Ores, Minerals, &c.;* Sam'l. Porter, Hartford, Connecticut, December 2.

Claim.—"I do not claim the device of arranging a movable pan in a vibrating frame, and of operating the same, so as to give a double motion to the pan, since letters patent for this invention have been granted to Arnold Buffum and Philip Thorp. What I claim as my invention is, the arranging and operating of a series of ore-washing pans, or sets of pans, in a vibratory frame; said pans or sets of pans, having also an oscillating or rocking motion, in the frame, in such a manner that as the superficial portion of the contents passes freely from any one pan or set of the series into the next, the contents shall, at the same time, pass out of the latter less freely, or not at all, and *vice versa,* substantially as already described.

"2d, I claim, also, the arranging in a vibrating frame, of a series of pans, or sets of pans, one after the other, each pan or set being hung upon the frame by a separate axle, or equivalent attachment, and secured in its working position by a catch, or other equivalent means, in such a manner that each pan, or set, may be conveniently disconnected and tilted, so as to discharge its whole contents into a receptacle, separate from those of the other pans.

"3d, I claim also, the arranging of a succession of groups of pans, by a constant duplication for the subdivision of the contents, in such a manner, that the contents issuing from each pan of any one group, the last excepted, shall pass, by an equal division, into the two pans of the next succeeding group, substantially as described."

---

30. For an *Improvement in Car Seats;* Ezra Ripley and E. L. Brundage, Troy, New York, December 9.

Claim.—"Having thus described the nature of our invention, what we claim as new is, the arrangement of the reversing arms pivoted midway the height of, and to the back, so as that they shall descend and slide through the pivot rollers, so as that any required height of back may be reversed from one side of the seat to the other, in the manner and for the purpose, substantially the same as described."

---

31. For *Improvements in Lath Machines;* G. W. Tolhurst, Cleveland, Ohio, December 9.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, so arranging the frame that carries the reciprocating or chopping knives and feeding apparatus, as that whilst cutting, it shall at all times rest by its own weight on the bolt, or log, in advance of the portion thereof which is being cut, in combination with the mode as herein described, of giving to the knives carried in said frame, an alternating

drawing movement towards and from the log, independent of the downward motion or position of the frame, by which means the block may be entirely reduced to laths, while the whole weight of the knife frame is resting on it, to keep it firm and solid.

"I also claim, in combination with the cutter stock, the feeding plate for feeding up the log to the cutters, a "throw" being given to said stock for that purpose; and this I claim, whether the same is accomplished by the means herein specially set forth, or by any other means essentially the same."

---

32. For an *Improvement in Running Gear of Railroad Cars;* Thomas A. Davies, City of New York, December 9.

Claim.—"What I claim as new and original is, adapting to each side of railroad car tracks, four or more wheels attached to a frame work, inflexible vertically, but with a horizontal motion, in such a manner, that in case of depressions in the rails at their joinings, or otherwise, they (the wheels) will alternately be couplets, triplets, or the like, receive the weight of the load above, and relieve the wheel passing over the depression, from the weight of the load and frame work, so that no concussive blow is struck with that weight or jar created, substantially as above described."

---

33. For an *Improvement in Chair Seats;* John W. Drummond, Skaneateles, Assignor to Smith Ely, New Brighton, New York, Dec. 16.

Claim.—"What I claim as my invention is, the above combination of the frame and web, being the mode of securing the web to the frame, as herein set forth, by gluing or cementing the web into a groove in the frame."

---

34. For an *Improvement in Weavers' Temples;* Elihu and Warren W. Dutcher, North Bennington, Vermont, December 16.

Claim.—"What we claim as our invention is, the roller temple, constructed as herein set forth; the roller working in a concave, so that the cloth is held at that line of the periphery of the roller which is nearest the reed, at which line the roller is enabled to perform its duty with the greatest efficiency."

---

35. For an *Improvement in Combining Organs and Piano Fortes;* Richard M. Ferris, City of New York, December 16.

"The nature of my invention, which relates to the combination of certain or all of the tubes of the organ with the piano-forte, consists, not in the combination, but in the manner of effecting it, so that either the piano-forte or organ can be played separately, both at the same time by the same set of keys, or one by one hand and the other by the other hand of the player, each being provided with a separate set of keys, and either set being capable of being coupled with the other set, so as to be operated at the same time.

"It also consists in the employment of a set of pedals, for operating on certain or all of the piano-strings and organ pallets; the said pedals are capable of being coupled with either the organ or piano keys, or both, or uncoupled altogether."

Claim.—"I do not claim combining the organ and piano-forte, irrespective of the manner in which the combination is formed; but what I claim as my invention is, 1st, The whole or any number of the tubes of an organ, with a distinct set of keys, in combination with a piano-forte, having its own proper set of keys, in such a manner, that either the piano-forte or organ can be played separately, or both at the same time, by the two sets of keys, or both coupled and played by one set of keys, by means of couplers, P or O, and eccentric bars, *h*, *j*, or other equivalent devices, substantially as herein described.

"2d, Coupling either or both the organ and piano with a pedal action, R, *n*, Q, and uncoupling them from it, by means of couplers T, U, acting on the keys and eccentric bars *t w*, or their equivalents, so that either the organ and piano-forte, or both, can be played upon by the pedals, substantially as herein set forth."

---

36. For an *Improvement in Carriages;* Gustavus L. Haussknecht, New Haven, Connecticut, December 16.

Claim.—"What I do claim as my invention is, 1st, The employment of segments *c*, *d*,

and fifth wheels, F, G, (or parts corresponding thereto,) attached as described; the one segment, *d*, and fifth wheel F, working on pivots *f*, *n*, secured at points between the front and hind axle, such parts acting in combination with arms *j*, *p*, constructed substantially as shewn and described, for coupling the movement of two axles, or their turning appurtenances, for the purposes set forth."

37. For *Machinery for Making Kettles and Articles of like Character, from Disks of Metal;* Hiram W. Hayden, Waterbury, Connecticut, December 16.

Claim.—"I do not claim any of the gear wheels, or pinions, nor their arrangement, except as hereafter set forth, some of these being common in ordinary lathes; but I do claim as new, 1st, The application of a rotary metallic form or mould, or successive forms or moulds, in combination with a proper tool or tools, roller or rollers, sustained, moved, and directed in a proper path, by competent mechanical means, for the purpose of operating on a disk, blank, or plate of metal, so as to reduce it gradually from the centre to the edge, at the same time forming it with straight sides by successive stages, into a complete kettle, or into any similar articles, to the forming of which the apparatus can be applied, substantially as described and shown.

"2d, The construction of the mandrel *f* 3, part of which is cylindrical, and part fitted with a short screw, 13, to take the screw of the hand wheel, *f* 2, so that great pressure may be made at the point desired, while at same time, the mandrel can be easily and quickly moved through a long distance, for the purposes as described and shown."

38. For an *Improvement in Adjusting Lenses;* Wm. & Wm. H. Lewis, City of New York, December 16.

Claim.—"We do not claim to be the inventors of any of the parts herein described and shown; neither do we mean to limit the application of these means to cameras, but to use the same, to adjust the focal distance of lenses in optical instruments, wherever the same may be made available; what we claim as new and of our own invention is, the combination of the pin 2, spring *f*, and groove 1, with the cylinders *a* and *b*, for the purposes and as described and shown."

39. For an *Improvement in Stethescopes;* Nathan B. Marsh, Cincinnati, Ohio, December 16.

Claim.—"What I claim as my invention is, the double branch, *c c*, connected with the main trunk *a*, so as to enable persons to use both ears simultaneously, substantially as herein set forth and described."

40. For an *Improvement in Mineral Composition Resembling Jasper;* John Paige Pepper, New Britain, Connecticut, December 16.

Claim.—"What I claim as my invention is, the manufacture of a mineral composition, having the external characters above described, by the fusion of clay with alkali, soda, lime, and sulphate of copper, as above described, or their equivalents, and working the composition into articles of utility and ornament, in the manner above described."

41. For *Improvements in Rotating Tumbler Locks;* David H. Rickards and Jos. F. Flanders, Newburyport, Massachusetts, December 16.

Claim.—"We do not claim a combination of geared change wheels and notched circular plates, applied together on one common arbor, so that the said change wheels and circular plates shall lay side by side on the said arbor, by which arrangement of them, they require to be removed from the arbor, in order to change the catch of any one wheel from any notch or hole of its circular plate, into any other of the notches or holes of the said plate; but what we do claim as our invention is, combining with the rotary tumblers and the change gears (arranged as set forth) the projection or tooth *r*, or its mechanical equivalent, and the sliding frame G, (or its equivalent,) for holding and guiding the tumblers during their rotations, and for moving them out of or into connexion with the change gears, all substantially as herein before specified.

"And we also claim the arrangement of the tooth or bit c, and the stud g, on a sliding and turning shaft, in combination with the arrangement of the arm E, and the tumblers, so that when a person tries to move the tumblers, he cannot get end play on the bolt, and vice versa.

"And in combination with the change gears and the arbor e, we claim the friction spring or springs a^1, and plate b^1, for the purpose above described."

---

42. For an *Improvement in Candlesticks;* Francis A. Rockwell, Ridgefield, Connecticut, December 16.

Claim.—"I do not claim the employment of a movable detached cork or other elastic substance, over which a sliding socket is allowed to move; nor do I claim the employment of a sliding socket; but what I claim as my invention is, the employment, in the sliding socket candlestick, of elastic packing attached to the standard of the candlestick, substantially in the manner described, whereby I am enabled to support the sliding socket, prevent the leaking of the grease, and also am not obliged to use so long a sliding socket, as where a cork is inserted loose in the socket."

---

43. For an *Improvement in Chimney Tops;* Chas. W. Russell, Washington, District of Columbia, December 16.

Claim.—"I do not claim either the arch B, or the end plates C, C, or the end plates a a, and b b, irrespective of the devices in connexion with them; but what I claim as my invention is, 1st, the flanches, c c, applied to the arch B, in combination with the end plates C C, substantially in the manner and for the purpose herein set forth.

"2d, The inclined plates a a, and b b, applied to the arch B, substantially as and for the purposes specified."

---

44. For an *Improvement in Churns;* Henry Skinner, Attica, New York, December 16.

Claim.—"Having thus described the nature of my invention and improvement, I wish it to be understood that I make no claim to originality of invention in any of the individual parts of the churn, except the dasher; and this I claim, only when it is constructed with inclined perforated paddles, and tapered elbow tube L, combined, for directing the cream or milk upward, and also throwing it centrifugally against the ribs B, and concave surface of the churn tub A, during the operation of churning, in the peculiar manner herein set forth."

---

45. For a *Blind and Shutter Operator;* Noah W. Speers, Cincinnati, Ohio, December 16.

"The object of my invention is to provide a simple and secure method of operating and fastening outside window shutters and blinds, without opening the windows; and I have invented the present, in view of a number of contrivances which appear to me to be lacking in strength, when force is applied, such as high winds, &c."

Claim.—"Having thus fully described the nature of my improvements in window blind operators and fasteners, what I claim therein as new is, the combination of the extension handle k, (provided with taper ends,) with the lever h, and the studs j j^1, or their equivalents, by which the handle can, by extension, be made to possess the requisite leverage, and by which, when the lever arrives at that portion of its sweep, corresponding to the required position of the blind or shutter, it is firmly secured in its position, and the handle placed out of the way, by the latter being thrust home against the studs, the whole being arranged substantially in the manner described."

---

46. For an *Improvement in Apparatus for Pressing Garments;* Jos. W. Thorp, South Weare, New Hampshire, December 16.

Claim.—"Having thus described my improvements, I shall state my claim as follows: What I claim as my invention is, suspending the goose in a tailor's pressing machine, from a carriage traveling on rails, on the end of a vertical spindle; also arranging said spindle, so that it may be moved vertically and swivel or turn upon its axis, substantially as herein above set forth.

"I also claim arranging said goose upon the rod, passing through the forked end of said spindle, so that it may slide forward and back upon said rod, as herein above set forth.

"Furthermore, I claim the combination of a goose, arranged substantially as herein above described, so as to move in the several directions specified, with a platform box, susceptible of adjustment, as specified, and heated substantially as herein above set forth."

---

47. For an *Improvement in Processes for Smelting Copper Ores;* Samuel F. Tracy, City of New York, December 16.

Claim.—"That which I claim as my invention and discovery is, the use, as a flux for ores, combined with an excess of silica, of the sub-silicate of iron, obtained from the second smelting, or from iron furnaces.

"The grinding of the regulus or mat to a powder, (instead of merely breaking it into lumps or fragments,) so that a perfect oxidation can be obtained, and leaching with water, which aids the oxidation and extracts the sulphuric acid, when generated, as that acid greatly retards the refining process, when combined with the metallic copper."

---

48. For an *Improvement in Tailors' Measures;* Edward Virtue, Philadelphia, Pennsylvania, December 16.

"The nature of my invention consists in proportioning all the measures of the body of coats and vests to the measure of the breast of the individual measured. The breast measure determines all others, except the sleeve measures and length of skirts."

Claim.—"What I claim as my invention is, the mode of cutting coats and vests, by making all the principal parts to depend, in length, on the length of the breast measure, substantially as herein described."

---

49. For an *Improvement in Grain Sieves;* Thos. B. Wheeler, Albany, New York, December 16.

Claim.—"What I claim as my invention is, forming sieves for separating grain from straw, chaff, and all extraneous matter, and for other analogous purposes, of sheet metal, with apertures, B, B, cut or otherwise made in it, and inclined leaves A, A, under the said apertures, of corresponding form with the apertures themselves, substantially as herein set forth."

---

50. For an *Improvement in Pumps for Elevating Water Mixed with Mineral Substances;* William Ball, Chicopee, Massachusetts, December 23.

Claim.—"I claim the improvement by which the waste auriferous or earthy water, that leaks out of the shaft hole of the case A, is saved and returned into the body of the case, and the wear of the shaft hole of the chamber *q* prevented; the said improvement consisting in the chamber *q*, the wheel *r*, and the passage *t*, as combined together, connected with the case A, and the shaft of the fan wheel, and made to operate substantially as specified."

---

51. For an *Improvement in Chronometric Locks;* William L. Bass, Boston, Massachusetts, December 23.

Claim.—"Having thus described my improvements, I shall state my claim as follows: What I claim as my invention is, the manner of disengaging the drop lever from the notch of the bolt, from the outside of the partition, when the clock is stopped, and preventing the same from being effected when the clock is in motion, by means of the lifting screw, in combination with the forked lever, swinging loop, and ratchet wheel, substantially in the manner above described."

---

52. For an *Improved Machine for Making Leather Tubes;* Newell Wyllys, South Glastonbury, Assignor to Charles Collins and N. Wyllys, Hartford county, Connecticut, December 23.

Claim.—"Having thus described the construction and operation of my machinery for forming flexible tubes, what I claim as my invention is, 1st, the method of forming the

blanks or sheets, of the proper size and form for tubes, from leather or other suitable material, by means of the movable and stationary nippers and inclined knife, or the equivalents thereof, operating automatically, substantially as herein set forth.

"2d, I claim the method of forming flexible tubes from prepared sheets or blanks, by means of fingers, clamps, and cement, or their equivalents, acting substantially as herein set forth, to bring the edges of the sheet into contact, and to unite the same.

"3d, I claim combining in a single machine, the operations of forming the leather or other material into blanks, bringing the edges of the same into contact, and uniting them, so as to form a tube at a single operation, substantially as herein set forth.

"4th, I claim the clamp, by means of which the material is held, and upon which it is formed into a tube, constructed and operating in such manner that it shall, in addition to its movements towards the other clamp, also have a longitudinal movement to withdraw from the finished tube, substantially as described.

"5th, I claim the combination of the reciprocating diverging fingers with the reciprocating converging plates, or their equivalents, by whose action the fingers are made to seize the sheet of material, substantially as herein set forth.

"6th, I claim the method of coating the edge of the sheet with cement, by means of a roller, or its equivalent, which receives the cement, and applies it to the edge to be cemented, substantially in the manner and for the purpose herein set forth.

"7th, In combination with a clamp, or its equivalent, for supporting the edges of the sheet of material to be united, I claim a reciprocating pressing iron, actuated substantially as herein set forth, to press the edges together and to set the cement."

---

53. For a *Rotary Swaging Machine;* Perry G. Gardiner, City of New York, December 23.

Claim.—"What I claim as my invention, discovery, and improvement, is, the compressing, drawing, swaging, or working into shape, wrought iron car wheels, and other metallic disks, by means of two dies or swedges, suitably shaped, one of which is forced towards the other, while it at the same time revolves on its own centre, its axis of revolution being the same as that of the disk which is acted upon; the other die being either stationary, or having a revolving motion in an opposite direction to that of the first mentioned die, and with the same axis of revolution; the said two dies or swedges operating substantially as described, and being moved by any competent arrangement of machinery, substantially as described."

---

54. For an *Improvement in Suspenders;* Julius Hotchkiss, Assignor to the Hotchkiss and Merriman Manufacturing Co., Waterbury, Connecticut, December 23.

"My improvement consists in fastening the different pieces or parts of the suspender together, wherever a permanent fastening is necessary, by means of a metallic clamp of peculiar construction, made and applied."

Claim.—"What I claim as my invention is, the fastening of those different parts of a suspender to each other, which require a permanent fastening, by a metallic clasp or clamp, substantially in the manner and for the purposes hereinbefore described."

---

55. For an *Improvement in Candle Making Apparatus;* Willis Humiston, Troy, New York, December 23.

"The nature of my invention consists in the manner of wicking the mould, by suspending the candles or wick above the same when drawn, so as that the wick shall draw from a reel, and suspend it in the centre of the mould, for the next succeeding candle to be moulded thereon, in the operation of drawing the candles from the moulds."

Claim.—"Having thus described the nature of my invention, I do not wish to be understood as claiming the drawing the candles and suspending them above the moulds, whereby the latter are wicked for the casting of the next series of candles, this having been before done; but what I do claim is, the employment of gripers for griping the wicks, drawing and suspending the candles on the frame above the moulds, by means of spring bearings, by which the gripers are held firmly closed, and the candles are securely held and suspended until the next series of candles are moulded, when those suspended are cut from the wick and removed, in the manner and for the purpose described."

56. For an *Improvement in Æolian Attachments;* Gustavus W. Ingalls, Concord, New Hampshire, December 23.

Claim.—"What I claim as my invention or improvement is, the combining with the valve stem or rod, a movable bar, or any equivalent mechanism, by which such valve stem, or the head thereof, whenever desirable, may be moved out of action with the key lever, for the purpose essentially as described."

---

57. For an *Improvement in Carriages;* Lewis King, Madison, New York, December 23.

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, the employment or use of the chain and pulley, in combination with the dogs and slide bar, constructed and operating in the manner and for the purpose substantially as set forth; the lower ends of the dogs being raised or depressed by means of the levers, operated upon by the square or loop, or any other equivalent device, and the slide bar attached to or detached from the pole by means of the levers and pawl, operated upon by the bent lever, or their equivalents."

---

58. For an *Improvement in Harness Saddles;* John McLain, Circleville, Ohio, December 23.

Claim.—"Having thus fully described my improved harness saddle, and the advantages thereof, what I claim therein as new is, the sliding gauge hinge boxes, attached to the pads, so as to adjust the width of the saddle by the screws, substantially as described.

"I also claim the manner of attaching the sliding gauge hinge boxes to the pads by means of the housings between them and the top of the pad, and the set screws passing through the plate *f* and top of the pads, substantially as herein set forth."

59. For an *Improvement in the Method of Hanging Window Sashes;* Samuel D. Nims, Palmer, Massachusetts, December 23.

Claim.—"I am aware that strips acted upon by springs have been placed in grooves in window sashes, and also in grooves in the casing, for acting on the sashes for the purpose of excluding air, and for sustaining the sashes when raised, in place of weights, and therefore I wish it to be understood that I do not claim the said arrangements as any part of my invention. But what I do claim as my invention is, the manner herein described of arranging and securing window sashes in their frames, by means of grooves in the sides of the window frame or casing, that receive the edges of the sashes, or by projections from the sides of said frame or casing, that fit into grooves in the edges of the sashes, and by making one or both sides of the window frame or casing movable and elastic, by means of the springs or their equivalents."

---

60. For *Improvements in Cutters for Planing Machines;* James M. Patton and Wm. F. Fergus, Philadelphia, Pennsylvania, December 23.

"The nature of our invention consists in the peculiar construction and operation of a cutting instrument to be employed in planing machines, for reducing the boards to an uniform thickness, and in a modified form, for reducing the boards to an uniform width, and for tonguing and grooving them."

Claim.—"We do not claim the formation of cutters by placing circular saws obliquely upon their arbors, as this has been done before; but what we do claim as our invention is, the constructing of a cutting instrument for operating upon lumber, of one or more elliptical shaped saw or saws, placed upon an arbor, in positions so oblique to the direction of its axis as to bring every portion of the periphery of said saw or saws into the same perpendicular distance from the said axis of their arbor, by which the teeth of the said saw or saws are made to perform a combined rotary and laterally reciprocating cutting action in the same circle of rotation, substantially in the manner herein set forth."

---

61. For an *Improvement in Apparatus for Making Wrought Iron direct from the Ore;* James Renton, Newark, New Jersey, December 23.

Claim.—"I do not wish to limit myself to the use of a puddling furnace for the final operation, nor to the use of mineral coal, as the same result, in kind, may be produced by

a bloomery. What I claim as my invention is, the arrangement of a series of flat vertical tubes, or the equivalent thereof, in a vertical stack, substantially as described, when these are combined with a puddling or other furnace, substantially as described, by means of an interposed ore box, substantially as and for the purpose specified.

"I also claim combining with each of the deoxydizing tubes, as described, and at the middle and lower end thereof; a double inclined plane, substantially as described, to insure the equal descent of the charge of ore, as described.

"And I also claim, in combination with the series of the oxydizing tubes and the ore box, substantially as described, the employment of a series of stationary and a series of adjustable inclined planes, substantially as described, to regulate and insure the equal discharge of the ore from each, and from the whole series of tubes, as described."

---

62. For an *Improvement in the Method of Setting up Ten Pins;* Thomas E. Shull, Lewistown, Pennsylvania, December 23.

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, attaching the pins to a disk or plate by means of cords, in combination with the adjusting screen and guide screens, by which the pins are properly adjusted or set up on the alley, upon raising and lowering the disk or plate, as described; the disk or plate being operated by means of the cord passing over the pulleys and around the wheel, power being communicated to the shaft, or by any other mechanical means."

---

63. For an *Improvement in Machines for Counting Screws and Pins;* Thomas J. Sloan, City of New York, December 23.

Claim.—"What I claim as my invention is, the cylinder or wheel formed with recesses on its periphery, for the reception of the screws or other articles to be counted, and provided with a groove for the reception of and in combination with the detector, to indicate, mark, and register the number of screws or other articles that are delivered; the whole being constructed and made to operate substantially in the manner specified."

64. For an *Improvement in Bolt-heading Machines;* Nathan Starks, Albany, New York, December 23.

"The machine represented in the accompanying drawings is arranged to form square heads upon bolts; it consists mainly of a strong frame, to support the various moving parts of the machine; of a set of griping dies, to gripe the neck of the bolt blank, on which a head is to be formed; of the punch and its stock, for thickening or upsetting the extremity of the bolt blank; of the shaping dies, for giving form to the thickened extremity of the bolt blank, and of the mechanism by which the punch and dies are operated."

Claim.—"Having thus described my improved machine for heading bolts, what I claim therein as new is, the combination of the upsetting punch, the dies for shaping the sides of the head, the levers for working the dies, and the protuberance on the punch stock for actuating the levers, so that by the forward movement of the punch stock, the punch is caused to upset the end of the bolt, and by its retrograde movement the dies are worked, which give shape to the sides of the head, as herein set forth."

---

65. For *Improvements in Spinning Rope Yarns;* Richard Sands Tucker, Brooklyn, New York, December 23.

"The nature of my invention consists in spinning yarns for cordage, upon bobbins having movable head or movable heads, so that the yarn can be packed tightly upon the bobbin in spinning, and when full, the yarn can be removed from the bobbin, whereby the inner end of the thread or yarn can be hauled or drawn out, in the process of rope making, in forming the "readies" or strands of cordage; thus saving much expense in labor and bobbins, besides the great advantage of hauling or drawing out the yarns or thread from the inner end."

Claim.—"What I claim as my invention is, spinning rope yarns upon bobbins having movable head or heads, so that the yarn can be packed tightly upon the bobbin in spinning, and after spinning can be removed from the bobbin, to be transferred and hauled off into strands for cordage from the *inner* ends thereof, without unwinding, thus effecting a great saving of bobbins and labor."

66. For an *Improvement in Machines for Dressing Stone;* William Wheeler, West Poultney, Vermont, December 23.

"My improvement consists in the cylindrical tool-holder, in which the cams revolve that cause the tools to act upon the stone; the said cylinder acting as a support to the cams and shaft; and it also enables me to bring the tool on to the stone in any direction, cutting equally well when the carriage is moving forward or back, or while cutting over the top surface, or up and down the ends."

Claim.—"Having thus fully described my improvements in cutting stone by machinery, what I claim therein as new is, the cylindrical tool-holder, constructed and arranged substantially as herein set forth, so as to hold the tools or chisels, and turn them in a direction to cut either way, keeping them in such position as always to receive the blows from the cams in the same relative direction, and also incidentally to support the cam shaft, by means of the cams resting against its interior, should the cam shaft spring."

---

67. For an *Improvement in Machines for Ruling Paper;* John Ames and George L. Wright, Springfield, Massachusetts, December 23.

"The machine hereinafter described is for the purpose of ruling a sheet of paper on both of its opposite pages or sides, and down the page, so as to have a heading or margin at the top of each side or page."

Claim.—"Having thus described our improvements, what we claim is, 1st, the shaft and its projections, (operating as above set forth,) or any mechanical equivalent contrivances, in combination with the carrying apparatus, or endless tapes, on which the sheets are received, moved, and introduced to the action of the ruling apparatus, such carrying apparatus being made so as to operate essentially as above described.

"And we also claim the shaft and its lifters, in combination with the carrying apparatus or endless strings, and the two sets of ruling apparatus, or contrivances for supporting and ruling the paper on both sides, as described, such shaft and lifters, or the lifting apparatus, as it may be termed, being for the purpose of changing the overlap of the sheets, in manner as herein before explained."

---

68. For *Improvements in Attaching Cutters for Cutting Screws on Rails of Bedsteads;* Jacob Zimmer, Tiffin, Ohio, December 23.

Claim.—"Having thus described my improvement in securing V-shaped cutters in rotary cylinder heads for cutting screws on tenons of bedstead rails, I wish it to be understood that all I claim as my invention is, forming an opening in the end of the cylindrical head, so as to allow the cutter to be placed therein laterally, or inserted into its seat sideways, and securely confined, in the manner herein before set forth, whereby the cutter requires no adjustment, and is retained firmly in its position."

---

69. For an *Improvement in Setting Mineral Teeth;* John Allen, Cincinnati, Ohio, December 23.

Claim.—"What I claim as my invention is, the new mode of setting mineral teeth on metallic plates, by means of a fusible siliceous cement which forms an artificial gum, and which also unites single teeth to each other and to the plates upon which they are set.

"I also claim to be the inventor of said cement or compound, a full and exact description of which is herein given.

"I also claim the combination of asbestos with plaster of paris, for covering the teeth and plates, for the purpose of sustaining them in their proper position while the cement is being fused."

Re-issues for December, 1851.

1. For an *Improvement in the Manifold Permutation Lock, for Doors, Vaults, &c.;* Robert Newell, City of New York; patented September 25, 1838; re-issued December 2, 1851.

Claim.—"What I claim as new and of my invention is, 1st, the application of slides or their equivalents, in combination with tumblers, each so constructed that the slides shall be set through the tumblers by a key or any arrangement of the key-bit sections, or the

equivalents of the same, and then retained as set by any competent means, so that noteh tumblers resuming their quiescent positions, they abut against the slides, and prevent the retraction of the bolt, substantially as described and shown, but independent and irrespective of the means used to secure the slide in place.

"2d, I claim the manner of fitting the slides with the eramp and nut, so as to retain the slides in the position they have been placed in by the key-bits and tumblers, as described and shown.

"3d, I claim constructing the barrel of the key-bit in such a manner, that it may be inverted with reference to the handle or shank, substantially in the manner and for the purposes herein described."

DESIGNS FOR DECEMBER, 1851.

1. For a *Design for Stove Registers;* David Stuart and Jacob Beesley, Assignors to William P. Cresson, Philadelphia, Pennsylvania, December 2.

Claim.—"What we claim as our invention is, the ornamental design for a register, as herein described and represented in the annexed drawings."

---

2. For a *Design for Stoves;* Jeremiah D. Green, Troy, Assignor to Backus, Bacon & Co., Le Roy, New York, December 9.

Claim.—"What I claim is, the ornamental design and configuration of a cook stove, substantially the same as described and represented in the annexed drawing."

---

3. For a *Design for Stoves;* Winslow Ames, Assignor to Hartshorn & Ames, Nashua, New York.

Claim.—"The said design consists of the ornamental semi-star and rays and mouldings of the end or side of the top plate, (as seen in the drawings,) the circular ornament A, and four or more surrounding ornaments, B, C, D, E, together with the mouldings of the top and bottom plate, all essentially as represented in either of the side or end views, and their sections; and such ornamental design, substantially as exhibited in the above mentioned drawings, I claim as my invention or production; and I also claim the ornamental design or configuration of the water urn, as shown in figures 1, 2, and 3."

---

4. For a *Design for Frames for Presses, Mantel Pieces, &c.;* Edwin L. Freeman, Belleville, New York, December 23.

Claim.—"What I claim as new is, the design of the frame for presses, mantel pieces, &c., above described."

JANUARY, 1852.

1. For an *Improvement in Ventilating Railroad Cars;* Noble S. Barnum and Lewellyn Whitney, New Haven, Connecticut, January 6.

"My invention consists in the employment of an axle, or shaft, (which is designed to be used in connexion with the car ventilator,) and which is placed on the bottom of the car, the ends of which shaft being secured in movable or sliding boxes, which operate in combination with the loose pulleys, &c., in such a manner as to allow the cars to travel over curved tracks, without the necessity of employing elastic belts."

Claim.—"What we claim as our invention is, the employment of the shaft O, sliding boxes *g*, and the springs *k;* the whole operating in combination with the pulleys, R, T, in the manner and for the purpose herein set forth."

---

2. For an *Improvement in Carriage Hubs;* Samuel S. Barry, Brownhelm, Ohio, January 6.

Claim.—"What I claim as my invention is, the combination of the conical bearing point F, (fig. 2,) the female centre, or step D, the thimble N, rollers M, and flanch E, arranged in the manner substantially as described, and for the purpose set forth."

3. For an *Improvement in the Construction of Bridges;* Wendel Bollman, Baltimore, Maryland, January 6.

Claim.—"Having thus fully described my improved construction of bridges, what I claim therein as new is, the combination of the tension rods *e*, connecting the foot of each strut with each end of the stretcher, substantially as described, by which an independent support is given to the strut carried back directly to the abutment, while, at the same time, no lateral force or strain is brought upon the abutment, as herein fully set forth."

---

4. For an *Improvement in Modes of Covering Cheeses;* Upson Bushnell, Gustavus, Ohio, January 6.

Claim.—"I claim as my invention, the spring cylinder with cleats, and open at the side, in combination with the framed stool, with circular opening, to admit and hold the cylinder within the sack, while the cheese shall be passed through; all as herein described and for the purposes stated."

---

5. For an *Improvement in Lock for Carriage Curtains;* George Cook, New Haven, Connecticut, January 6.

Claim.—"What I claim as my invention is, the constructing or manufacturing of coach curtain locks, each consisting of a polygonal knob and an eyelet having a polygonal central aperture of corresponding form and size, so that at certain relative positions, the knob head will pass freely through the eyelet, while in other relative positions, the knob cannot pass through the eyelet, on account of the prominence of its angles.

"I also claim attaching the knobs and eyelets to the articles which are to be thereby connected, in such relative positions, that the knob head cannot be made to pass through the eyelet, either for the purpose of connecting or disconnecting, unless the eyelet or knob is turned from its ordinary and proper position; both the knob and eyelet being constructed in the manner and for the purpose herein described."

---

6. For a *Machine for Turning up the Edges of Sheet Metal Disks;* Jos. F. Flanders, Newburyport, Assignor to Franklin Roys and Edward Wilcox, Berlin, Connecticut, January 6.

Claim.—"I do not claim as my invention, the use of cylindrical rollers, for either bending or beading a circular tin plate, when held between and rotated by holders or gripers; but what I do claim is, the employment of the spherical segmental bending roller *k*, in connexion with the conic frustum roller *a*, to operate together, and so as to enable me to either turn down the flanch at a right, acute, or obtuse angle, all essentially as specified, and at the same time dispense with the necessity of having several sets of holders or gripers, to bend the tin plate against, as heretofore practised."

---

7. For an *Improvement in Clover Harvesters;* Mahlon Garretson, Bermudian, Pennsylvania, January 6.

Claim.—"Having thus described my improvements in the clover head harvester, what I claim therein as new is, the lateral projections whose ends are fitted into the mortises or recesses in the shanks of the cutters, and whose upper front edges are made sharp; said projections serving the two-fold purposes of interlocking with the contiguous cutters and acting as cutters themselves, as described, for severing the heads from the stalks."

---

8. For an *Improved Steam and Water Gauge;* Wm. C. Grimes, Spring Garden, Philadelphia, Pennsylvania, January 6, 1852; ante-dated July 6, 1851.

Claim.—"What I claim herein as my invention is, the combination of the elevated glass syphon, containing a portion of air above, with the metallic tubes containing water below, arranged with respect to each other and the index, as herein described, for the purpose of showing or indicating the height of the water, and also the pressure of the steam, in steam boilers, at an elevation above or at the desired distance therefrom."

9. For an *Improvement in Camphene Lamps;* R. V. De Guinon, Williamsburgh, New York, January 6.

"The object of my invention is to obviate explosion; and the nature of it consists in constructing the reservoir of the lamp with a false bottom, or chamber, communicating with which and the reservoir near the top, is a tube or passage, that serves to receive and conduct the camphene or other fluid, as it increases in volume by expansion."

Claim.—"What I claim as my invention is, constructing lamps with a lower chamber or equivalent receptacle thereto, such chamber or receptacle being connected with the reservoir near its top, by a tube or passage, or other similar communication, substantially in the manner and for the purposes set forth."

10. For an *Improvement in the Manufacture of Railroad Chairs;* Peter P. R. Hayden, Columbus, Ohio, January 6.

"The nature of my invention consists in forming the chair out of wrought flat plate, or bar iron, made with convex raised surfaces therein, on its one side, which when the bar is cut to the required length for the formation of a chair, serve to make the lips thicker, at or near the roots, when cut and bent, without incurring any extra labor, to give additional and requisite strength at those parts."

Claim.—"What I claim as my invention is, rolling iron plates for rail road chairs, upon rollers so constructed that the portions intended to form the lips of the chair, shall have a greater thickness than the rest of the plate, substantially as herein set forth."

11. For *Improvements in Iron Railings;* George Hess, Assignor to Sylvanus Shimer, Easton, Pennsylvania, January 6.

Claim.—"I do not claim as my invention any of the parts of the within described railing, nor any of its minor combinations separately; but I do claim a combination, consisting of the following enumerated parts, viz: the top rail with its notches and end hooks; the lower rail with its notches, end hooks, and groove; the palings with their notches, hooks and T's; the posts with their openings for the ends of the rails, and the key bar by which the rails, posts and palings are firmly fastened together; the whole constructed and arranged substantially as herein described."

12. For an *Improvement in Daguerreotype Pictures;* Henry E. Insley, City of New York, January 6.

"The nature of my invention consists in producing an image of greater boldness and relief at the same time, casting a halo of various tints around the image, gradually blending in the dark or black outer edge."

Claim.—"What I claim as my invention is, the contracted opening to the mercury bath, and the separating or raising the plate from the contractor, during the operation of mercurializing; thus graduating the mercury upon the plate, producing the various tints, and gradually blending the outer edges of the gauge."

13. For an *Improvement in Wool Picking Machines;* Edward Kellogg, New Hartford, Connecticut, January 6.

Claim.—"I do not claim any improvement in the feeding table, ratchet feed roller, main picking cylinder, or any separate parts of the above described machinery. What I do claim as new and as my invention, is the application and use of the comb-plate to the upper and forward edge of the shell, when combined with the compound shell, to hold the comb-plate as above described; the several parts thereof being combined for the purpose aforesaid.

"And I claim the small recess just below the upper edge of the shell, for the purpose described and set forth."

14. For an *Improvement in the Construction of Shovels;* Hiram Kimball, Worcester, Massachusetts, January 6.

Claim.—"What I claim as my invention is, an improvement in the construction of

the common shovel, as follows, to wit: 1st, the attachment of malleable iron or other metal, consisting of the lip, the flanch, and the socket, and the mode of fastening the same to the blade, as herein before described.

"2d, The mode of fastening the lower end of the stock of the handle, by means of a socket and single strap, with the ends deflected upwards on the front and back side of the stock, and thus connecting the handle with the blade of the shovel.

"3d, The construction of the upper end of the handle, consisting of the socket, the ribs, the cylinder and the rivet, and the mode of connecting the same with the upper end of the stock, by means of the socket, as substantially and fully herein before set forth."

---

15. For *Improvements in Felting Cloth;* Joseph Weight, Lawrence, Assignor to Samuel Lawrence, Boston, Massachusetts; patented in England, October 7, 1841 January 6.

Claim.—"Having thus described my improvements in the manufacture of felted fabric I shall state my claim as follows: I do not claim the manufacture of felted cloth generally, nor do I claim the use of flat platens in felting cloth; but what I do claim is, the felting of wool or other fibrous materials, upon a woven or netted fabric, substantially as herein above set forth.

"And I also claim the use of one or more moving platens, having a reciprocating rectilinear motion, in the direction of the length of the cloth to be made, over one or more stationary platens, in combination with the endless cloth bands, operated substantially as described, for carrying forward and regulating the motion of the material, while under the action of the said platens, substantially as set forth."

---

16. For an *Improvement in Breech Loading Fire Arms;* Richard S. Lawrence, Windsor, Vermont, January 6.

Claim.—"What I claim as my invention is, mounting the barrel on a spindle attached to or projecting from the breech piece, so that the barrel can be turned thereon, to carry the bore to the side of the breech, for the insertion of a cartridge, and back to close the bore against the breech piece, substantially as herein described; but this I only claim in combination with the stationary breech piece, provided with a cutting edge at the side, to cut off the rear end of the cartridge, and with a projection at the top, extending over the barrel, and grooved transversely, to receive a lip from the barrel, to bind the barrel to the breech piece, to resist the force of the discharge, as herein described."

---

17. For an *Improvement in Feeding Rollers in Straw Cutters;* Nathaniel Nuckolls, Columbus, Georgia, January 6.

"My improvement consists in presenting the straw sideways to the knives, and causing it to move against stationary knives, when cutting, instead of moving the knives against the straw."

Claim.—"Having thus fully described my improved straw cutter, what I claim therein as my invention is, the enlargement of the knife grooves on the feeding cylinder in the manner and for the purpose set forth."

---

18. For an *Improvement in Processes of Bleaching Ivory;* Ulysses Pratt, Deep River, Connecticut, January 6; ante-dated July 6, 1851.

Claim.—"I do not claim the bleaching of ivory upon a frame exposed to the rays of the sun passing through glass, placed above the same; but what I do claim as my invention is, the improvement in the process of bleaching ivory, as set forth in the specification, that is to say, the raising up of one edge of the piece of ivory above the plane of the frame which supports it, and sustaining it in its place, in the manner described."

---

19. For an *Improvement in Pen and Pencil Cases;* John W. Ranch, City of New York, January 6.

Claim.—"I do not claim the extension case, as a sliding tube working in a case has been previously invented; neither do I claim a slide case for both pen and pencil, as that

is at present in use; but what I claim as my invention is, the collar encompassing and sliding freely on the pencil tube, said collar having a slot or recess cut through it, as shown and described, through which the spur of the pencil slide may pass, by which arrangement either the pencil slide or pen holder may be operated without interfering with each other; the collar being prevented from turning on the pencil tube by means of the spur working in the slot in the sliding tube, and also by which arrangement, I combine the extension case with the slide case, for both pen and pencil, substantially as set forth."

---

20. For an *Improvement in Gold Pens;* Adam W. Rapp, Philadelphia, Pennsylvania, January 6.

"By this improvement the gold pen is made to embrace all the qualities of the quill pen, and in this, I consider, lies a superiority of my improvement over all others; but the more prominent advantage is in the saving of gold, by the reduction of the thickness at *a*."

Claim.—"Therefore what I claim as my invention and improvement in the gold pen is, reducing or thinning the sides of the pen at (*a*,) between the shoulder A, and split (*c*,) whereby the advantages above stated are fully attained, and the gold pen made to possess the qualities of the quill pen."

---

21. For an *Improved Mechanical Gold Beater;* Robert B. Ruggles and Lemuel W. Serrell, Assignors to Robert B. Ruggles, City of New York, January 9.

Disclaimers and Claims.—"We do not intend to confine or limit ourselves to the application of these means to beating lumina or leaves of metal, but to use this machine to beat any article to which it may be applicable; for instance, the "turn over" motion may be applied to a plate or similar article, or articles, that require to be beat on both sides, and the arrangement herein shewn, of means for extending or decreasing a given motion, may be applied to move any article in the given direction, and extend or decrease the area of such motion, as required. And it will also be seen, that this means of taking motion from the motion of the hammer tail to give definite motion from an uneven or varying motion, may be employed in other machines, for the like purposes; and we do not intend to limit ourselves to the sizes or proportions of the parts, nor their precise arrangement, relatively with each other, but to vary these as circumstances may require.

"We do not claim the hammer, or the means of moving or actuating the same; neither do we claim the use of cams to move the mould; but what we desire to secure by letters patent of the United States is, 1st, we claim the arrangement and application of the vibratory fork *g*, to take a definite amount of motion from the vibratory part g^1, of the hammer, for the purposes, and as described and shown.

"2d, We claim lifting the "mould," or its equivalent, from the anvil, and simultaneously or subsequently turning the same by competent mechanical means, substantially such as herein described, or their equivalents, so that it is replaced with the side that was previously on the anvil exposed to the blows of the hammer.

"3d, We claim the arm *n* 1, latch 30, levers *o* and *o* 2, chain 33, and crank *o* 3, or their equivalents, in combination with a weighted arm, or its equivalent, whereby a sudden partial rotation is given to the shaft *o* 1, and then the lever *o* is returned behind the latch 30, for the purposes and as described.

"4th, We claim, in combination, the lever *q*, latch 41, cranks 35, frame *t*, and links 38, or their equivalents, whereby the "mould" or its equivalent is lifted from the anvil, turned, and replaced as described.

"5th, We claim the application of the rollers 71, 72, 73, and 74, or other suitable mechanical means, set and moving at right angles with each other, and to the centre of the cam shaft, to take and communicate the motion given by a properly formed groove, or bead, in or on the face of the cam H, to the mould, so as to place it in the proper position to receive the blows of the hammer, to beat each successive quarter of the mould, as described.

"6th, We claim moving the mould, or its equivalent, over areas of different size, by means of the same cam, through the agency of mechanical contrivances substantially such as herein described, applied to the devices which transmit motion from the cam to the mould.

"7th, We claim the arrangement of the slides *y y* 1, rollers 68, forks 70, with the cranks *w* 2, *w* 3, and *v v* 1, and levers *w* and *x*, to communicate the motion given by the

cam H to the rollers 71, 72, 73, and 74, to the "mould" through its frame *s*, substantial as described and shown.

"8th, We claim the adjustable fulcrum 53, and slides *v* 4, in combination with the lev *w* and *x*, for the purposes specified.

"9th, We claim the parallel motion bars *u*, and slotted bars *u* 2, in combination wi the slots 46 and 47, in the frame *s*, whereby the "mould" and frame has a free motion, the same time that it is kept parallel with the sides of the anvil, or the slotted bar *u* 2.

"10th, We claim the arrangement of the forked springs *w* 4 and *x* 1, and pins 58, and 62, 64, or their equivalents, as applied to the purpose of returning the "mould" to central position, when commencing to beat each quarter of the "mould," as described a shown."

---

22. For an *Improvement in Trucks for Locomotives;* John L. White, Corning, N York, January 6.

Claim.—"Having thus fully described my improved truck, what I claim therein as m is, the joint connecting the truck with the boiler, consisting of a long semi-cylindri bearing and an adjustable eccentric, for putting the truck in line, substantially in the ma ner and for the purposes set forth."

---

23. For an *Improvement in Cast Iron Car Wheels;* Horace W. Woodruff, Waterto New York, January 6.

Claim.—"What I claim as my invention is, casting a railroad car wheel with a chill rim and solid undivided hub, connected by means of a plate, which is single and solid certain parts, so that imaginary radial lines from hub to rim will pass through the s solid parts, and double and bent in opposite directions, between the single and solid par and wholly or partly from hub to rim, substantially as specified; the whole constituti one casting, substantially as and for the purpose specified."

---

24. For an *Improvement in Ventilating Windows for Railroad Cars;* Henry M. Pain Worcester, Massachusetts, January 6.

Claim.—"I am aware that repeated attempts have been made to prevent the spar from entering the cars, by deflecting boards or slats, but they have been outside, or ind pendent of the windows; they could not be adjusted by the passengers themselves; th are an additional expense, and cannot effectually shield off the dust and sparks, unle they should cover the window, so as to obstruct the view therefrom; therefore, I do n wish to be understood as not claiming a deflector: but what I do claim as my inventi is, the construction and arrangement of the windows of a car or carriage, in the mann and for the purpose set forth, by causing the parts of the window to stand at an ang outward when closed, and opening inward to a line with the inside of the car, as describe whereby I insure ventilation, without the annoyance of dust, by means of the windo alone, without the addition of other deflectors."

LAW REPORTS OF PATENT CASES.

Battin vs. Taggert and others.

Validity of Re-issued Patents.

These were three actions at law brought by Battin, for the infringeme of a patent granted to him for an improved coal breaker. The pate was originally granted on the 6th of October, 1843. On the 20th of Ja uary, 1844, certain improvements made subsequent to the date of th original patent were added to the patent. This patent was afterward surrendered, and a new one issued on the 4th of Sept. 1849.

The three actions being for similar infringements of the same patent

were tried together before Judge Kane and a jury in the United States Circuit Court for the Eastern District of Pennsylvania, from the 4th to the 15th of November, 1850. The cases were argued by Messrs. Keller and Dallas for the plaintiff, and by Messrs. Hughes and Mallery for the defendants. A verdict of 800 dollars was found for the plaintiff in each of the three actions.

After the verdict, the defendant filed reasons and moved for a new trial. The motion for new trial was argued before Judge Kane, from the 26th to the 30th of May, 1851, by Messrs. Shepperd and Mallery for the motion, and Messrs Porter, Cadwalader, and Dallas against the motion. Several questions were discussed during the argument, but the motion was disposed of on the ground of the invalidity of the re-issued patent. The positions taken by the respective counsel, are noticed in the opinion of the Court, which was delivered on the 10th of September last, granting the new trial.

The opinion of the Court on defendant's motion for new trial, was delivered September 10, 1851, by Kane J.

The several cases in which Mr. Battin is plaintiff, are before the Court on a motion for new trial. They were tried together, and on the trial, several points of law were reserved by the Judge, and exception was taken by the defendants to his ruling of several others. All of these have been ably reviewed in the present argument. One question, however, determines the motion, and dispenses with the consideration of the rest.

Mr. Battin obtained a patent on the 6th of October, 1843, for a new and useful improvement in the machine for breaking and screening coal, which he defined in his specification as one in which the breaking and screening were effected simultaneously by a set of breaking rollers of a certain form, operating in connexion with an assorting screen. His 'claim' was for the manner in which he had arranged and combined these together.

On the 20th of January, 1844, he described certain improvements which he had made in his machine, and caused them to be included in his patent right. These are not important to the question before us now, but the specification in which they are set out, refers to his original invention as having consisted "in the combining of the breaking and sifting apparatus with each other."

The case of Battin vs. Clayton grew out of an alleged infraction of this patent of 1843; and we held on the trial of it, that the patent being merely for the combination of machinery, it could neither be supported nor assailed by proof of the novelty or want of novelty of the parts. The patent was thereupon surrendered, and a new one issued on the 4th of September, 1849, under an amended specification, which described essentially the same machine as the former one did, but claimed as the thing invented, the breaking apparatus only.

The defendants are using this apparatus, and the jury in the several cases found against them for infractions of the re-issued patent. The damages, though liberal perhaps, do not seem to me excessive; and my own impressions are so strong, of the merits of the invention, that I have very great reluctance in disturbing the verdicts.

But there are two legal positions of a general character which appear to me to bar the plaintiff's right of recovery. They are these:

1. That a description by the applicant for a patent of a machine or a part of a machine in his specification, unaccompanied by notice that he has rights in it as inventor, or that he desires to secure title to it as patentee, is a dedication of it to the public.

2. That such a dedication cannot be revoked, after the machine has passed into public use, either by surrender and re-issue or otherwise.

The first of these propositions will hardly be disputed. If an inventor has a right at all to give up his invention to the world, there is no more unequivocal way of his doing so, than by publishing it on the records of the patent office, and at the same time making no claim to it as his exclusive property. There is no need of a formal disclaimer, where no claim can be implied; and the implication is all the other way, when of several things described, one is claimed without the rest.

The second proposition also seems to be susceptible of easy demonstration. Protection is given to an inventor under the patent laws, as the consideration for his disclosing what was not known before—not as a tribute of civic gratitude for "good deeds past." He loses his right if he allows his invention to become known before he patents it, and when he does patent it, he is required so to describe it at the very outset, that others may not only know how to use it profitably after his patent shall have expired, but be able to distinguish it from other things while his patent is in force.

These are the conditions upon which he is promised the protective intervention of the law for the secure enjoyment of his exclusive property; and they are reasonable ones. He should not be allowed on the one hand to frame his disclosure so indefinitely as to make it practically useless to the community he is contracting with, or to require them to make experiments in order to learn what his meaning was. The law of his contract assumes that his own investigations have defined the character and extent of his invention, as well as its appropriate objects, and its practical usefulness with reference to them, and that he is about to give the fruits of his experience to the world.

Not that he is required to hold back his claim of protection till he has matured or even imagined every modification of his inventive idea. He may describe and claim what he knows, and as he knows it; and leave the office of perfecting it to others. But if he does so, he must not complain that others more scientific, or more ingenious, or more practical, or more patient than himself, come after him to claim property in that which might have been his own, but which he suggested, without appropriating. It may be that his mind is of the higher class, that distinguishes between an isolated, unreasoned fact and the illustration of a principle, and the knowledge which he imparts takes the form therefore of a general instead of a particular truth; and such also may then be the character of his patent. But what he has discovered he must in every case announce and describe, if he asks for it protection as his property. He may not mystify where he cannot teach; he is not to shut out others from the field of invention, except so far as he has occupied it himself and marked its boundaries.

Nor should he be allowed on the other hand, to defer the assertion of

his right, till others have been led by his silence to regard it as waived in their favor, and to make investments of capital, industry, or skill on the faith of such a waiver. The protection of skill, in its broader sense, is the peculiar object of the whole system of patent laws; and it would be specially unjust to the men who represent the skill of community, that they should be invited to elaborate the unclaimed suggestions of a patentee, and be precluded afterwards from using the results of their own invention by finding them embraced in the more general expression of his discovery, as set out in an amended specification—that very expression suggested in its turn perhaps by what they had done and published, or perhaps even patented themselves. The general rule is therefore a just as well as a long established one, that the patentee must stand or fall, according to the assertions of right, that he has made in his application.

The exceptions harmonize in principle with the rule. They apply to those cases, in which there has been formal error, which may be amended of course; or those in which the patentee has by inadvertence described his invention imperfectly, and offers a more accurate description as a consideration of the grant for the amended patent; or those in which, having ignorantly claimed more than he was entitled to, he desires formally to acknowledge his mistake, and renounce the right he had asserted. In the first of these cases, good faith exacts that he be allowed to repair the error; in each of the others, the public is to be a party benefitted by the modification of his patent right.

The Act of 1836 provides therefore, (Sect. 13,) that whenever a patent shall be inoperative or invalid, by reason of a defective or insufficient description or specification, or by reason of the patentee claiming in his specification as his own invention more than he had a right to claim as new, if the error has arisen from accident, inadvertency, or mistake, and without fraudulent or deceptive intention, a new patent may issue to the inventor for the same invention, in accordance with a corrected description and specification for the residue of the unexpired term, or, if the original claim has been so framed that the erroneous part of it may be stricken out without impairing the full and intelligible import of the rest, the patentee may, under the 7th Section of the act of 1837, file a disclaimer, in lieu of an amended specification.

But neither of these sections authorizes a change in the character of the claim—the substitution of a different patentable subject. The defect to be remedied, is either some insufficiency of description or an error in claiming too much. The patentee may make his specification more accurate, or he may restrict the limits of his claim, but a disclaimer cannot expand his right; and his re-issued patent taking the place of the one he has surrendered, must be for the same invention which he sought to patent from the first.

Were the law otherwise, it would be a perilous thing to admit of improvements in the machinery and processes of our workshops. There would be no knowing what was patented and what public; an inventor would have only to amplify his description and illustrate it well by drawings and models, postponing his claim to some part or other of it until it had passed into use, to be secure of many perfectly legitimate rights of action, for discussion afterwards in the Courts, or more profitable adjustment by compromise.

It is no answer to this, that such a course would be fraudulent; for how is such a fraud to be detected? Can the Commissioner refuse an amendment which comes to him supported by the patentee's oath, and altogether in harmony with the description, drawings, and models that accompanied his first application. Where is the proof to come from, of a "deceptive intention" on his part?

Nor is it an answer to say that, according to the 13th Section of the Act of 1836, the amended specification is to be without operation or effect, except "on the trial of actions for causes accruing subsequently." The process newly claimed may have required a large preparatory outlay, expensive buildings, peculiar machinery, large purchases of material, widely extended contracts, and the special education of skill. To apply these to their proposed use, or to continue applying them, after the specification has been amended, will constitute a "cause of action subsequently accruing," which the law will give damages for, and equity interpose to prevent. It costs some thousands of dollars to erect a machine like the defendant's, and it is valueless to him if he is not allowed to use it.

I hope that I shall not be understood as animadverting on the plantiff, in these remarks. His conduct appears to have been entirely fair, and I am truly sorry that he fails of the protection he has sought, for the want of a specification, properly drawn in the first instance. The discussion is of a principle, not of an individual case.

Nor does it really involve a question of good faith. Public policy, the safety of all who are watching the advance of art, and availing themselves of it, for the purposes of practical use, the intelligent and enterprising artificers of progress, the thinking mechanic, who labors to improve upon what is known to make things better than he finds them, the capitalist who rewards skill and labor while he shares their earnings, and the entire community, made richer, happier, wiser, and better, by the results of judiciously directed industry—all demand that a clear and definite line shall distinguish between that which is prohibited and that which is free; a line not to be varied capriciously or without full previous notice, nor with the changing opinions of individuals as to the character and extent of their exclusive interest, nor to the prejudice of any vested interest of the many.

Mr. Battin's invention, as he now defines it, was in use for nearly six years before he claimed that it was his property. He had made it known as an unprotected element of the combination he patented in 1843. It was not till 1849 that he asserted any other right in it for himself than he conceded to every body else. He cannot reclaim what he has thus given to the public.

Per Curiam. New trial granted.

MECHANICS, PHYSICS, AND CHEMISTRY.

*The Marine Steam Force of Great Britain.**

Great Britain possesses one hundred and forty-seven steam-ships, including three in Canada, and thirty-two iron steamers, eleven ranging from 1547 to 1980 tons. Of these, four were formerly 76-gun ships, and

* *From the Glasgow Practical Mechanic's Journal, for August, 1851.*

have now engines of 450 horse power. The largest, the Simoom, of 1980, has only 350 horse power; the Terrible, however, of 1850, has engines of 800 horse power; the Termagant, of 1547, has engines of 620 horse power; while the Arrogant, of 1872, has only 360 horse power; the Retribution, of 1641, has 400 horse power. One of the above eleven, the Penelope, was a 46-gun frigate. Fifteen from above 1200 and under 1500 tons, twenty-seven above 1000 and under 1200, twenty-three above 700 and under 1000, nine above 500 and under 700, twenty-seven from 250 and under 500, twenty-two from 150 and under 250, four from 42 to 149; three on the lakes of Canada, one of 406 and of 90 horse power, and one of 750 and of 200 horse power; twelve packets, 237 to 720, some of which are very fine vessels; 58,643 in commission, and 58,501 tons in ordinary. Of the steamships there are built of iron—the Simoom, 1984; the Vulture, 1764, both 350 horse power; the Greenock, 1418, and 550 horse power; the Birkenhead, 1405 and 556 horse power; the Niagara, 1395, and 350 horse power; the Trident, 850, and 350 horse power; the Antelope, 650, and 264 horse power; the packet Lizard, 340, and 150 horse power; the Bloodhound, 378, and 150 horse power; the Grappler, 557, and 220 horse power; the Sharpshooter, 503, and 202 horse power; the Harpy, 344, and 200 horse power; the Myrmidon, about 350, and 180 horse power, the Sphynx and Fairy, about 300, and 110 horse power; and four other smaller vessels of 20 to 9 horse power. Six of the packets are built of iron. Screw steamers on the stocks, viz., one 30-gun at Devonport, one 80-gun at Woolwich, and one 80-gun at Pembroke; in all, one hundred and fifty steamships. Then there is the mercantile steam power. The steam vessels registered in the port of London on the 1st of January, 1851, was three hundred and thirty-three: one hundred and seventeen under 100 tons, sixty-four from 100 to 200, twenty-six from 200 to 250, twenty-seven from 250 to 300, sixteen from 300 to 350, nine from 350 to 400, ten from 400 to 450, eight from 450 to 500; three from 500 to 550, seven from 550 to 600, three from 600 to 650, six from 650 to 700, two from 700 to 750, five from 750 to 800, three from 850 to 900, one from 900 to 950, eight from 1000 to 1500, six from 1500 to 1800, eleven from 1800 to 2000, and one above 2000 tons. In Liverpool there were ninety-two steam vessels: twenty under 100 tons, forty-nine from 100 to 200, twelve from 200 to 400, six from 400 to 600, three from 600 to 800, one of 1300 tons, and one of 1609 tons. At Bristol there were thirty-one steam vessels: eleven under 100 tons, fourteen above 100 tons and under 300, three from 300 to 500, two from 500 to 600, one (Great Britain) of 2936. At Hull there were thirty-four steam vessels: eight under 100 tons, seven from 100 to 200 tons, eight from 200 to 400, eight from 400 to 700, two from 700 to 1000, and one of 1320 tons. At Shields there were fifty steam vessels: forty-eight under 100 tons, one of 388, and one of 106 tons. At Sunderland there were thirty-two steam vessels under 100 tons. At Newcastle-upon-Tyne there were one hundred and thirty-eight steam vessels: one hundred and thirty under 100 tons, six from 100 to 300, two from 300 to 500. At Southampton there were twenty-three steam vessels: nine under 100 tons, nine from 100 to 300, five from 300 to 500. At Glasgow there were eighty-eight

steam vessels: fourteen under 100 tons, forty-eight from 100 to 300, sixteen from 300 to 700, three from 700 to 1000, five from 1000 to 2000, two from 2000 to 2500. At Leith there were twenty-three steam vessels: eight under 100 tons, twelve from 100 to 500 tons, three from 500 to 1000 tons. At Aberdeen there were sixteen steam vessels: three under 100 tons, four from 100 to 300, three from 300 to 600, five from 600 to 1000, and one of 1117 tons. At Dublin there were forty-four steam vessels: three under 100 tons, fifteen from 100 to 300, thirteen from 300 to 500, thirteen from 500 to 800. At Dundee there were ten steam vessels: five under 100 tons, two from 100 to 300, three from 500 to 800. At other ports there were two hundred and seventy steam vessels: one hundred and thirty-nine under 100 tons, sixty-one above 100 and under 250, forty-five from 250 to 500, twenty-two from 500 to 750, and three from 750 to 1000.

"*A Description of a New Metallic Manometer, and other Instruments for Measuring Pressures and Temperatures.*" *By* M. Eugene Bourdon, *of Paris.**

In the course of manufacturing a coiled copper worm for a still, one side becoming flattened by accident, internal pressure by a force pump was applied, to restore the cylindrical form, and to the astonishment of the author, as the pressure increased, the coiled tube unwound itself. This induced further experiments, which resulted in the production of the various instruments described in the paper, an engraving of one of which will be found at page 164.†

The transverse section of the coil was that of a flattened tube, which when acted upon internally by the pressure of steam, or any other fluid, had a tendency to uncoil itself, as the density increased, and to return to its original form, on the pressure being removed. If it was exposed to external pressure, or a partial vacuum was created within it, the tendency of the tube was to coil itself up into a smaller diameter. In the former case, as the tube uncoiled itself, its sides became more convex, and its capacity became greater: and, in the latter instance, the capacity diminished as the sides collapsed and approached each other. It was on this relation between the capacity of the tube, or the amount of convexity of the sides, and the diameter of the coil, that the action of the instrument depended. If a flat band of metal was bent round a circle, its transverse form remained unaltered, but if a semi-cylindrical or gutter-shaped band, was bent into a circular coil, its convexity was diminished; and if the circle formed by it was of small diameter, the band became almost flat in the transverse direction. It being then a law of general application, that a surface which was curved in two directions could not have its curvature increased in one direction, without its curvature being diminished in the other direction, and vice versa, the action of the instruments in measuring pressure or temperature was easily understood.

The variation in the thickness, or capacity of a curved flattened tube, was shown by filling the tube with a liquid, and attaching to the centre of its external periphery, a small glass tube; when every change of cur-

* From the London Artizan for December, 1851.

† For description and illustration see Jour. Frank. Inst., Vol. xxii, p. 234.

vature produced a corresponding motion in the liquid in the tube; for as the tube was straightened its capacity increased, and as it curled up again it diminished.

The change in the thickness or capacity of the tube being proportional to the variation of its radius of curvature, it was found by experiment, that the motion of the extremities of the tube was in proportion to the pressure applied, so that the indications were equal for equal increments of pressure; this fact greatly facilitated the construction of the indicating instruments.

The simplest form exhibited was that of the steam pressure gauge, in which rather more than one convolution of flattened tube was employed; one end being attached to a stop cock, in connexion with the boiler, and the other extremity carrying an index pointer, which traversed a scale graduated to given pressures per square inch; on the steam being admitted, the tube uncoiled, and the pointer indicated the amount of pressure to which it was subjected. It is obvious that by attaching a pencil to the end of the pointer, and providing the ordinary apparatus for carrying the paper, the instrument is converted into a steam engine indicator.

When a greater range of motion was required, the lever, instead of being placed on the axis of the index, carried a toothed segment, which, working into a pinion on the spindle of the index, increased the extent of indication. This arrangement was adapted for barometers, in the construction of which the air was exhausted from the flattened tube, which was then hermetically sealed. The pressure of the atmosphere acted on the exterior, and was balanced by the elasticity of the tube, which varied in curvature with every variation in the pressure of the atmosphere.

In barometers, the tube is usually fixed at the centre, the ends being left free to move, and being connected to the ends of a lever. For marine barometers, balance weights are also provided, to counteract the weights of the ends of the tube, which would affect its accuracy, when the instrument was inclined from the perpendicular. Thermometers are constructed by filling the tube with spirits of wine, and a pirometer, for measuring high temperatures, can be formed by attaching to the instrument a platinum ball, full of air, the expansion of which, when acted upon, indicates the temperature.

The author has even constructed a model steam engine on this principle, which was exhibited at the Great Exhibition. This consisted of a steel tube, of horse-shoe shape, one end of which was fixed, whilst to the other was attached a connecting rod, taking on to a crank in the ordinary manner. An eccentric on the crank shaft moved a slide on the fixed end, to regulate the admission of the steam, and to avoid refilling the whole tube at every stroke, the tube was filled with oil. The pressure of the steam effected the one stroke, and the elasticity of the tube the other.

Mr. Brunell stated that he had tested one of Mr. Bourdon's barometers, and found it very accurate and sensitive. The heights of the floors in a house might be observed, as well as the gradients the experimenter passed over in a cab, or on a railway. In using the steam-gauge, it was necessary to avoid allowing it to become heated by the steam, which might be done by interposing a syphon, which would fill with water, and also by immersing the syphon in cold water.

It was suggested that a modification of the instrument might be used as a deep sea lead, the depth being indicated by the pressure, and the instrument being made self-registering.

The instruments were stated to be very generally adopted in France, where the government inspectors of steam engines used pressure gauges on this principle, in verifying the accuracy of all the other instruments they found attached to the engines under their inspection. At the French Exposition of 1849, M. Bourdon received a gold medal, and at the Great Exhibition in Hyde Park, he was rewarded by a Council medal.—*Proc. Inst. Civ. Eng., Nov. 18th,* 1851.

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* DR. L. TURNBULL.

Continued from page 63.

Edward Davy's Telegraph.

The next telegraph in chronological order is that of Mr. Edward Davy, of London. The patent for this telegraph was sealed July, 1838, and published in the *Repertory of Patent Inventions*, London, July, 1839. The specifications are very voluminous, and not very intelligible. I have therefore studied it carefully, and have given the important points, and a drawing, which fully illustrates the improvements which Davy proposed, being careful not to omit any vital part of his machine. In this method of treating it, I have followed the examples of Moigno and Sheilen, two of the latest writers upon the subject of the history of the telegraph.

In the telegraph of Edward Davy, the decomposing action of the galvanic current is employed to produce marks upon chemically prepared cloth, or other material; the cloth preferred by the inventor was *calico*. and the chemical substance employed by him to prepare the cloth was a solution of the iodide of potassium and muriate of lime.

He employed a local battery to produce the telegraphic signs by chemical decomposition. This battery also operated an electro-magnet, whose armature regulated the movement of the registering instrument. This battery is also connected with a short independent circuit, which is closed and opened by the movement of a magnetic needle, surrounded by a coil of copper wire, which forms part of the main circuit. He employed finger-keys to open and close the circuit: his receiving instrument being similar in principle to Cook and Wheatstone's, only closing his circuit like Mr. Morse, by the contact of solid metals, instead of mercury. When the main circuit is closed by the finger-keys, the needle is deflected which closes the short circuit; but when the main current is interrupted, the needle opens the short circuit by returning to its original position.

The cloth or other chemically prepared material is drawn between a metallic cylinder and a series of platinum rings surrounding a wooden cylinder; by these rings the current from a local battery is passed through the chemically prepared cloth to the metallic cylinder beneath, producing signs consisting of simple dashes arranged in six rows. The calico is

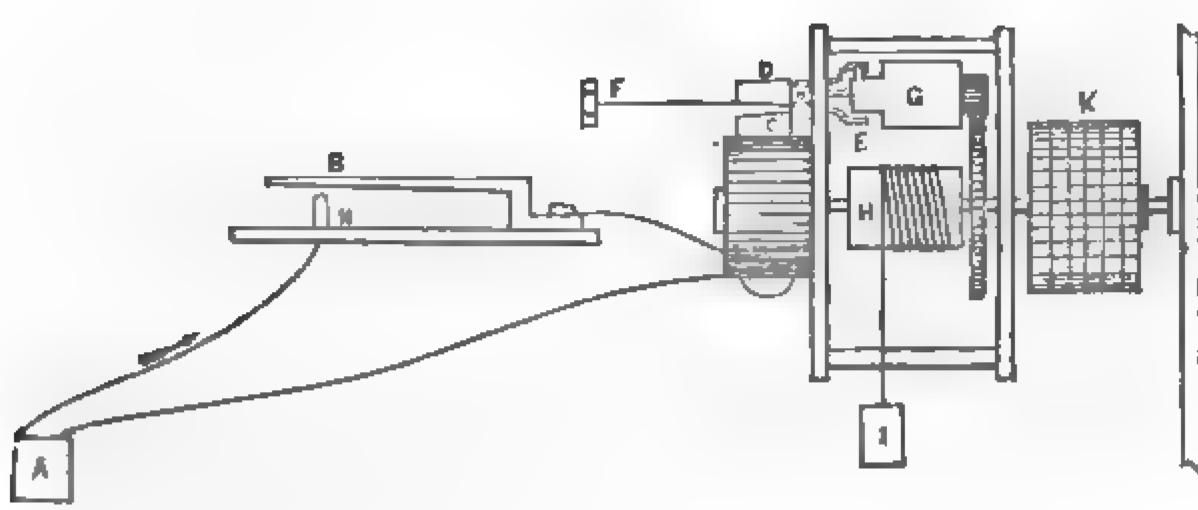
moved by clock-work, and this clock-work is regulated by a U electro-magnet, with an armature and lever, which at each motion withdraws the stop from a fly-wheel for the space of a semi-revolution, during which a single sign is made upon the calico, the clock-work moving always in proportion to the number of signs transmitted. The platinum rings were so arranged as to be connected separately or together, at will, with the other poles of the battery, but insulated from each other.

In his patent three telegraphic wires are represented, which are made by means of his commutator to connect a local circuit with either of the six platinum rings, so as to simplify the system of marking necessary to form the signs for the different letters of the alphabet.

There cannot be a doubt that Davy was informed of the telegraphs of Morse and Steinheil, by the following remarks at page 12 of his Specifications:

"I am aware that it has been proposed to use a marking instrument with lead or ink, by the aid of an electro-magnet, to make a number of dots or marks in immediate succession, to indicate the signification of such communication; I do not, therefore, claim the use of marking instruments generally, but only when they are adapted to make communications by marks across and lengthwise of the fabric which receives them, as above described."

Fig. 42.



The most ingenious portion is the escapement. The figure represents the principle of the escapement, and the electro-magnet. A is the voltaic battery; B lever; N metallic button, to which is fixed the wire conductor of the battery; C an electro-magnet; D the armature; I is a clock-weight; H the band of the wheel that carries the revolving cylinder of the signs, K; G is a van or regulator of motion; E a pair of pallets fixed to the armature D. On the side opposite the axis of motion, is fixed a spring, F, to separate the armature from the electro-magnet, by which the electric current is broken, and magnetism destroyed. The arrangement is such that for every revolution of the van G, the cylinder K advances one division, and a letter is impressed. If the lever B rests against the metallic button N, the metallic circuit of the voltaic battery is immediately established, the electric current passes along the conducting wires of the electro-magnet C, which instantly attracts the armature D, forces the superior pallet E to abandon the lever O, and permits the van to turn. As soon as it turns half a revolution, it is arrested by the inferior pallet, against which the *lever touches. The contact* of this lever, being aban-

doned, the voltaic circuit is instantly broken, magnetism destroyed, and the spring F leaves the armature in its first position. This movement lowers the inferior pallet, sets at liberty the lever O, and the second half of a revolution is performed, bringing it into a new position, and arrests it against lever O, or superior pallet. For each complete revolution, a character successively appears. The operation of successively elevating and depressing the key, gives the cylinder of signs a circular motion, in the same manner that the hand of a clock is made to revolve by means of balancing and escapement. On some cotton fabric are some longitudinal lines, intersected by transverse ones, dividing the surface into little squares. It is impregnated with iodide of potassium and chloride of lime, and wound on a cylinder that turns by a weight at each magnetic pulsation. The current traverses this prepared material, and leaves a well marked trace in the square indicated by the touch of the director. The position of the square in the net-work marked on the stuff, determines the letter or signal. This mode requires seven or eight lines, and has never been put in practical operation, though patented in January, 1839.

The following are the claims in full, as given in the original publication:

"First, The mode of obtaining suitable metallic circuits for transmitting communications or signals by electric currents, by means of two or more wires, which I have called signal-wires, communicating with a common communicating-wire, and each of the signal-wires having a separate battery, and, if desired, additional batteries, for giving a preponderance of electric currents through the common communicating-wire, as above described.

"Secondly, I claim the employment of suitably prepared fabrics for receiving marks by the action of electric currents for recording telegraphic signals, signs, or communications, whether the same be used with the apparatus above described or otherwise.

"Thirdly, I claim the mode of receiving signs or marks in rows across and lengthwise of the fabric, as herein described.

"Fourthly, I claim the mode of making telegraphic signals or communications from one distant place to another, by the employment of relays of metallic circuits, brought into operation by electric currents.

"Fifthly, The adapting and arranging of metallic circuits in making telegraphic communications or signals, by electric currents, in such manner, that the person making the communication shall by electric currents and suitable apparatus, regulate or determine the place to which the signals or communications shall be conveyed.

"Sixthly, I claim the mode of constructing the apparatus which I have called the escapement, whether it be applied in the manner shown, or for other purposes, where electric currents are used for communicating from one place to another.

"Seventhly, I claim the mode of constructing the galvanometer herein described.

"And lastly, I claim such parts as I have herein pointed out, as being useful for other purposes, as above described."—[*Repertory of Patent Inventions, July,* 1839.

Bain's Printing Telegraph.

The following extract of a letter is taken from a work, entitled "A

Account of some remarkable applications of the Electric Fluid to the Useful Arts: by Alexander Bain: edited by John Finlaison, Esq. London, 1843," which gives us the date of Mr. Bain's first telegraph:

"*Percival Street, Clerkenwell, Aug.* 28, 1842.

"Dear Sir:—I recollect visiting you early in June, 1840, when you showed me a model of your electro-magnetic telegraph.

"ROBERT C. PINKERTON."

In July, 1841, it was exhibited and lectured on at the Polytechnic Institution, London. It consists of three principal parts.

1st, The rotary motion given to the type wheel, step by step motion, like the second-hand of a clock, until the required letter arrives opposite the paper.

2d, The means of inking the types, or otherwise making permanent the imprint of the types upon the paper.

3d, The motion communicated to the paper, so as to bring a fresh surface under the types, and receive the printed intelligence in a continuous spiral line, until the book is filled.

He uses wire coils freely, suspended on centres, for electro-magnets. These coils, within and in the vicinity of which are fixed powerful permanent magnets, are deflected as long as the electrical current is passing through them; but when the electric current is broken, they are drawn upwards by the force of the spiral springs, the levers are released, and the machinery of the telegraph, worked by main springs, are left free to rotate. The only battery proposed by Mr. Bain is a pair of copper and zinc plates, one of which is to be buried in the earth at one station, and the other at the distant station, where there is to be a telegraph the exact counterpart of the first.

I have considered it entirely unnecessary to give a drawing of this telegraph, as it never could be of very great service; and as to the form of battery, it was entirely out of the question. The best evidence of this was, that an entire change was made in it by Mr. Bain in 1846, a description and drawing of which will be found in my article on Galvanic or Electro-Chemical Telegraphs.

I find in the same work the following account of some interesting experiments on the earth as a source of permanent voltaic electricity:

"In prosecuting some experiments with an electro-magnetic sounding apparatus, in the year 1841, it was found that if the conducting wires were not perfectly insulated from the water in which they were immersed, the attractive power of the electro-magnet did not entirely cease where the circuit was broken. For the purpose of investigating the nature of this phenomenon, a series of experiments took place, with great lengths of wire, in the reservoir of water at the Polytechnic Institution, when similar results were obtained. While reflecting upon these experiments, some few months after they had been performed, Mr. Bain was led to infer, that if a surface of positive metal was attached to one end of a conducting wire, and an equal surface of negative metal to the other end, and the two metallic surfaces put into water, or into the moist earth, (the wire being properly insulated,) an electric current would be established in the wire."

This proposition was soon tested by experiment. A surface of zinc was buried in the moist earth, in Hyde Park, and at rather more than a mile distance a copper surface was similarly deposited; the two metals were connected by a wire suspended on the railing, and on placing a galvanometer in the circuit, an electric current was produced, which passed through the intervening mass of earth from one plate to the other, and returned by the wire. In the first experiment, the metallic surfaces being small, the electric current produced was feeble; but on using a large surface of metal, a corresponding increase in the energy of the current was obtained, with which an electrotype process was conducted, and various electro-magnetic experiments performed with universal success.

It is essential to success, that the earth wherein the plates of metal are deposited should be of a moist nature. A current has indeed been obtained in dry soil, but of such small energy as to be of no practical utility.

A patent was solicited for the application of this mode of producing electric currents to his printing telegraph, and obtained in April, 1841.

This form of battery could never have been of any useful application to great distances, without an increase of the number of plates and of the exciting fluid.

Sturgeon's Electro-Magnetic Telegraph.

In the *Annals of Electricity* for October, 1840, is published a description and drawings of a form of electro-magnetic telegraph, proposed by William Sturgeon, of London, a man who has by his numerous experiments and researches into the subject of electricity and magnetism, conferred signal benefits on these important sciences, and has not received the full award of merit even from his own countrymen. The publication of the *Annals of Electricity* alone deserves the thanks of all interested in these important subjects, containing as they do a mass of valuable in ormation not to be found elsewhere in our language.

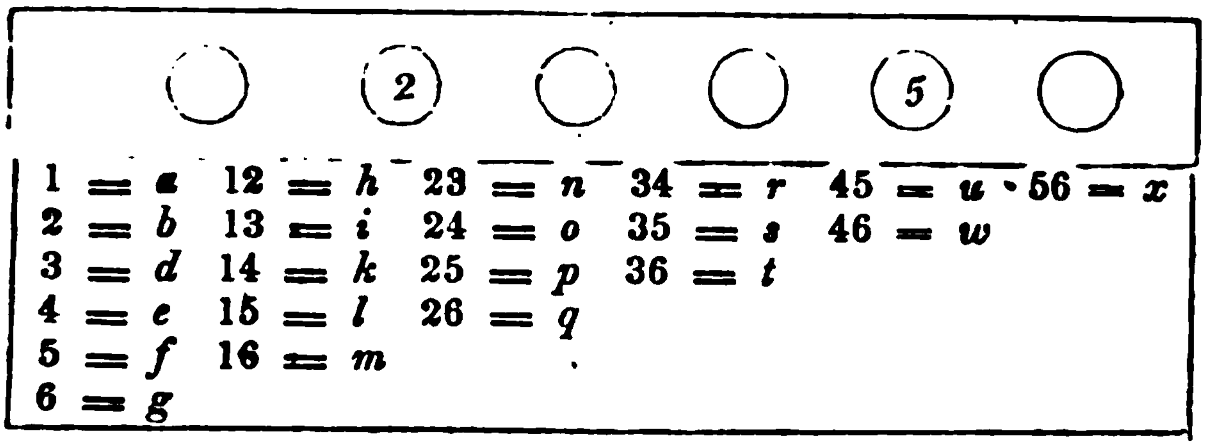
"In describing a new electro-magnetic telegraph, I am necessarily impelled by a similar feeling to that which urged my predecessors to bring their respective inventions before the public; and I cannot resist the idea that there will be found a peculiar simplicity both in the structure and management of the telegraph I am about to describe. Indeed, I shall point out the structure of two distinct telegraphs, having the sign common to both. Also, a third, differing very materially from the other two.

"In one of these telegraphs I use six soft iron bars, bent into the form of horse-shoe magnets, and covered with copper wire spirals, in the usual way, for converting them into occasional magnets by electric currents. To each magnet is a short bar of soft iron for a keeper or cross-piece, which is attached to the shorter arm of a lever, of the first order; and to the extremity of the longer arm of the lever is attached a circular card. The arrangement of one of these pieces of apparatus is shown by figs. 44 and 45, the former being a side view, and the latter an end view of it: *m*, in both figures, represents the magnet, *i* the cross-piece, *a b* the lever, and *f* the fulcrum. The cards at the longer extremities of the six levers are numbered 1, 2, 3, 4, 5, 6, which, individually, and by a series of simple combinations, form all the signals that are required.

"When the levers are in the position shown in figs. 44 and 45, the

magnet is out of action, in consequence of the battery circuit being interrupted. If, now, the battery circuit were to be closed, the magnet *m* would immediately be brought into action, and its attractive force would bring down the cross-piece *i*; which, being attached to the shorter arm of the lever, would raise the longer arm with its card and sign, into the position of the upper dotted circle, where it becomes visible through a circular opening in the face of the instrument, as at (5) in fig. 43. When that particular sign has appeared the required time to be observed, the battery circuit is opened, the magnet *m* loses its power, and the longer arm of the lever preponderating, again falls down to its first position, and the card with its sign disappears.

Fig. 43.



1 = *a*	12 = *h*	23 = *n*	34 = *r*	45 = *u*	56 = *x*
2 = *b*	13 = *i*	24 = *o*	35 = *s*	46 = *w*	
3 = *d*	14 = *k*	25 = *p*	36 = *t*		
4 = *e*	15 = *l*	26 = *q*			
5 = *f*	16 = *m*				
6 = *g*					

Fig. 44.

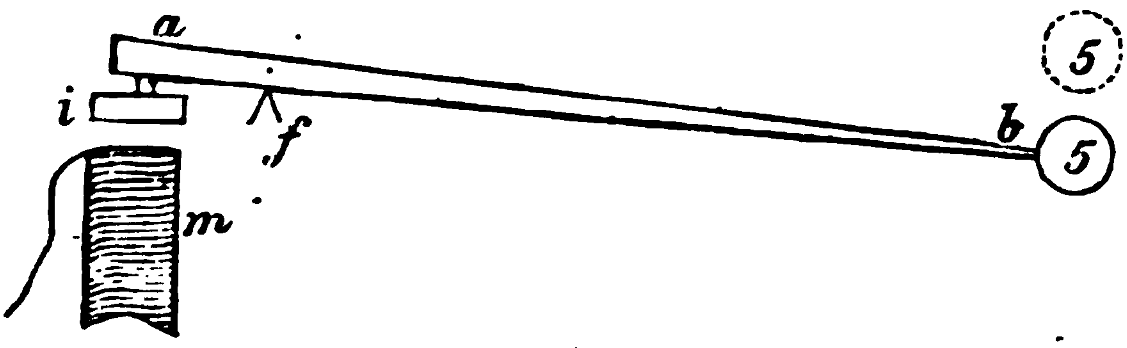
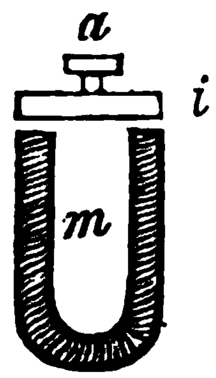


Fig. 45.



"The face or dial of the telegraph is represented by fig. 43, which may be either of painted wood or metal, silvered in the manner of clock faces, or barometer scales. On the upper part of the dial there are six circular openings, for the occasional appearance of the cards, with their figures, which are attached to the longer arms of the six levers. (See fig. 44.) Below the circular openings in the dials plate there are arranged the signals which are to represent all the alphabetical letters that are necessary for the spelling of words. The signals are thus continually before the eyes of the operator, and are too simple to miss being understood. These levers, with their magnets, &c., figs. 44 and 45, are placed behind the dial in a suitable case, and in such a manner that the figures on the cards may appear at the circular openings whenever their levers move upwards by the attractions of their respective magnets at the other, or shorter arms; and to disappear below those circular openings, when the magnets are out of action. To accomplish this latter effect, the face of the cross-piece of iron, which is attached to the short arm of each lever, must be covered by a card, or a film of some non-ferruginous matter, which will prevent close contact of the iron and magnet. By this arrangement of the apparatus, it is a matter of no consequence in what way the magnetic poles are arranged, because the attraction of the cross-pieces, attached to

the shorter arms of the levers, will take place as well with one arrangement as with another. But for uniformity, we will suppose that the coils on the magnets are all of the same kind, and that the north poles are to be in one and the same direction, towards the left hand for instance, to a person facing them, then those extremities of all the coil wires which were situated in one direction, might be collected together in one bundle, and either continued to the station where the battery is situated, or soldered to one stout copper conductor, at some short distance from the magnets, which conductor would become a general *fixed channel* between all the magnets at this station, and the battery at the other station. The other six ends of coil wires must be insulated by silk covering, and continued to the battery without metallic contact with each other. At the battery station these six insulated wires are to be attached to six wooden or ivory keys with springs, like the keys and springs of a piano forte; by the downward motion of which, the extremities of the wires become immersed in a long trough of mercury, connected with the opposite pole of the battery to that which the other conductor is attached to. On the top of each key is to be a conspicuous figure, corresponding to the figure which is to appear in the dial plate at the other station, so that when one finger is placed on key 2, and another finger on key 5, the magnets 2 and 5 at the other station are brought into play, and by attracting their respective pieces of iron, the figures 2 and 5 make their appearance on the dial as seen in fig. 43, and the letter p is understood. By these means, twenty-one of the letters of the alphabet can easily be represented without a possibility of error, either in the manipulation at the one station, or in the reading at the other; unless, indeed, there be a deficiency of attention which would incapacitate the attendants for employment at any telegraph whatever.

"The keys of this telegraph are sufficiently near to each other to permit the fingers to press on any number of them at one time, and, if necessary, the whole of the magnets may be brought into play at once, by the application of three fingers of each hand to the keys. By these means, the numerals may be grouped into combinations of three, four, five, and six, and thus, without the slightest confusion, a considerable number of signals would be obtained, which might represent words, or whole sentences, which would greatly expedite the transmission of intelligence from one end of the line to the other.

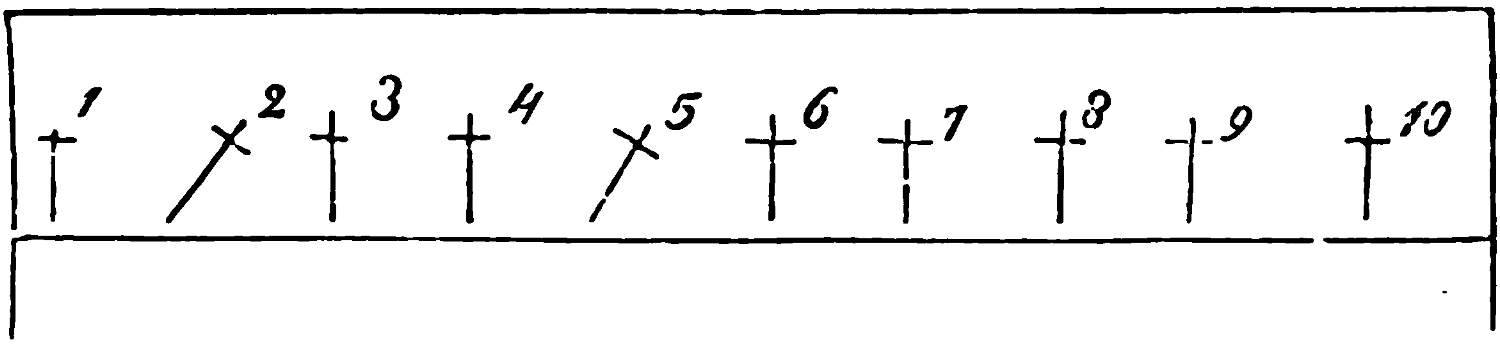
"There is a very great advantage in employing the numerals for signals. Not only because they are not so liable to lead to confusion as by the employment of the alphabetical letters, when used in combinations or groups; but because the subject of communication may be kept a perfect secret from one end of the line to the other; which is a most essential consideration in government expresses, and very often in those of mercantile affairs also.

"In this telegraph a seventh magnet is employed to ring a warning bell, as first proposed by Professor Steinheil.

"Although in the telegraph already described I employ soft iron magnets and levers to bring the signals into view, I am of opinion that magnetic needles in coiled conductors, or electro-magnetic multipliers, will be somewhat more prompt in their motions than the lever, at great dis-

tances from the battery. I therefore propose to make the necessary signals by means of magnetic needles, which can be moved with the same arrangement of conductors as that already described. And although I have only used six numerals for the signals, I am very far from supposing that the working of an electro-magnetic telegraph is facilitated or simplified by using a small number of original signals, or by having a small number of conductors. The simplest method of *spelling* words would be to have a needle for each letter of the alphabet, and the telegraph could be *made* and *worked* as easily by 24 needles as by a smaller number. And the words and sentences, which could be signified by combining them in pairs, or in groups of two each, would afford great facilities for the rapid transmission of ideas from one end of the line to the other. The needles could be placed in three horizontal rows, one above another, on a vertical dial plate.

Fig. 46.



"I have shown a dial plate in fig. 46, on which are placed 10 needles, with their respective figures or signs. As the needles can be deflected in only one direction, viz., with the north end towards the figure which belongs to it, there can be no mistake in understanding what sign is to be understood. I believe that any of these telegraphs will be found much simpler than those already before the public. They are capable of producing many more signs than any other known, and may be made at a less expense."

To be Continued.

For the Journal of the Franklin Institute.

English and American Propellers for Atlantic Navigation.

The success attending the *City of Glasgow* and *Manchester*, running to this port, and the *Glasgow* to New York, all English vessels, has led many, myself among the number, to be very much surprised at the partial failure, at least, of the *S. S. Lewis*, running to Boston, the *Pioneer*, to New York, and the *City of Pittsburgh*, to this port. And it has occurred to me that the great height of our American propellers above the water, and the consequent instability caused thereby, together with their very heavy rig, will account for the whole difference; for example, the *City of Manchester* is 274 feet long, 37¾ feet beam, and 31 feet hold, with an average draft of water of about 18 feet; while the *City of Pittsburgh* is 245 feet long, 38 feet beam, and 33 feet hold, with heavy houses on deck in addition, and to this must be added about 1½ feet as the difference of thickness of the bottom between wood and iron; her average

draft is 20 feet; it is very evident from this, that the section of the *Pittsburgh* above and below water is the greatest, which, combined with her heavy rig, must, during the prevalence of the strong westerly winds of winter, give the latter a decided advantage. The English custom, looking at the points and dimensions of their propeller ships, is to make them as low as is consistent with comfort and safety, and to obtain capacity by length. Which is right? Will some one answer? X.

For the Journal of the Franklin Institute.

Ship Building in New York for 1851.

The following is the number of vessels finished and remaining on the stocks in New York, at the close of the year 1851:

	Finished.	Unfinished.	Total.
Clipper Ships, ...	15	3	18
Ships, ...	7	1	8
Steamships and Propellers, . . .	17	5	22
Steamboats, ...	20	6	26
Barks and Brigs, ...	3	1	4
Pilot Boats and Schooners, . . .	21	7	28

Total, 106 vessels of all classes, whose aggregate tonnage is equal to 80,761 tons. Of the 22 vessels under the head of steamships and propellers, 17 are side wheel steamers.

The total number of side wheel sea-going steamers built up to this date is 53.

Hints on the Principles which should regulate the Forms of Boats and Ships; derived from original Experiments. By Mr. William Bland, *of Sittingbourne, Kent.**

Introduction.

As much difference of opinion has prevailed of late years respecting the true forms of ships, I have been induced to make a series of experiments with models of wood, to ascertain, by a careful noting of results, what are the governing laws. And I flatter myself I have been successful, in some measure, in detecting a few of the principles which influence the speed, the stability, and the safety of vessels impelled forward by the wind, the oar, and steam.

Chapter I.

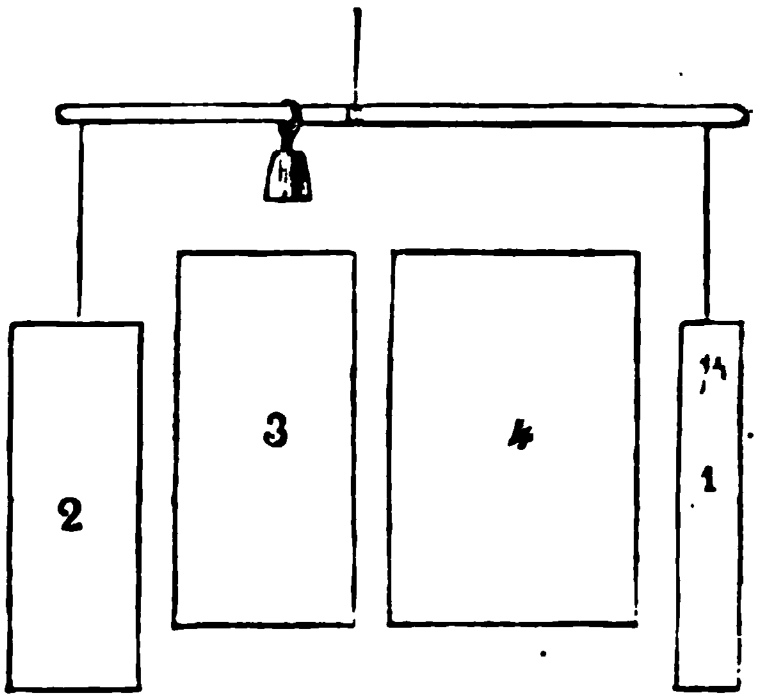
This chapter contains the particulars of experiments undertaken to gain a knowledge of the laws of water with regard to the head resistance it makes against bodies floating upon its surface, and impelled forward by some force, as the wind, the oar, and steam.

* From the London Architect, for September, 1851.

To this end, four pieces of deal were selected, of the same uniform density and thickness, and each 12 inches long, but varying in width.

No. 1 model, 2 inches wide and 12 inches long.
No. 2 model, 4 inches wide and 12 inches long.
No. 3 model, 6 inches wide and 12 inches long.
No. 4 model, 8 inches wide and 12 inches long.

These were, two at a time, attached by strings to the two ends of a balance-rod, of the length of 20½ inches; a third string, acting the part of a fulcrum whilst suspending the rod, was so put on the rod as to admit of being readily slipped along at the will of the experimenter; the other end being fastened to the small extremity of a long pole, for the purpose of reaching far enough over a pond of water to tow the models upon the surface, clear of all obstacles.



The Balance Rod.—Scale One-Twelfth.

The two models selected for experiment were then drawn on the water, and whichever of them preponderated, by meeting with greater resistance than the other, had the suspending-string shifted along the balance-rod until both the floating bodies attained an equilibrium of resistance, when the measure of their respective resistances was denoted by the inverse length of the arm or lever to which they were fastened. The shorter arm was made, in each experiment, to balance correctly the longer arm, by the means of a movable weight applied to the shorter arm.

Experiment 1.

Models.	Width.	Length.	Weight.	Difference.	Weight.
No. 1.	2 in.	12 in.	10 oz.	1⅛-inch of lever, or	2 oz.
No. 2.	4 in.	12 in.	10 oz.		

Experiment 2.

No. 2.	4 in.	12 in.	12¾ oz.	1⅛-inch of lever, or	2 oz.
No. 3.	6 in.	12 in.	12¾ oz.		

Experiment 3.

No. 3.	6 in.	12 in.	19 oz.	1⅛-inch of lever, or	2 oz.
No. 4.	8 in.	12 in.	19 oz.		

In these experiments the dimensions of the models were to each other

as 1, 2, 3, and 4; and the head resistance, compared two at a time, an of equal weight, gave the same results; consequently, the law of th head resistance is, that it increases directly with the increase of the squar surface opposed; and therefore in this instance of equal additions, assume the arithmetic ratio.

Chapter II.—Experiments made to ascertain the Law of the Resist ance of Water against the Increase of Weight.

Experiment 4.—For this purpose, two model boats were selected o equal draft, and into one was put a 1 lb. weight; and being drawn on th water by the same balancing-rod which was employed in the precedin chapter, and the difference of the resistance determined as before, the la revealed itself thus:—

With 1 lb.	weight, the	short arm was	7½	inches long.
With 2 lb.	"	"	6½	"
With 3 lb.	"	"	5½	"

That is to say, the resistance increases directly with the weight.

Chapter III.—Of Lateral Resistance.

A ship impelled through the water by wind acting on its sails, depend for speed in no small degree upon the lateral resistance it makes, and th situation of the centre of that resistance.

The following experiments were undertaken to ascertain the law, an how influenced.

Experiment 5.—First, around and near the midship section of a mode ship, was fastened, yet readily movable, one end of a line; the other en left to be taken in hand, a sufficient quantity of line being allowed be tween to tow the vessel through the water towards the shore, when place at some distance from the same.

And second, the model put on the water was repeatedly drawn to th shore, and the point of fastening of the line as frequently shifted. Th effects were these:

When the point of fastening was situated a trifle towards the head, th line on being pulled drew the head forward; and when fixed rather astern then the stern was drawn forward; thus proving, there existed a point o centre of balance. By carefully moving the place of fastening, it wa readily found, upon measurement, to be situated exactly in the mid-lengt of the keel and part of the projecting cutwater, the vessel floating upo a level keel.

During the carrying out of the above investigations, it was observed that when the vessel was made by the line to progress forwards, as wel as sideways, the centre of lateral resistance moved also forwards; an this, of course, was in consequence of its bows meeting with greater re sistance than when moved exactly sideways.

The reason is obvious; first, because the water at the bows becam condensed, and thus made greater resistance; and second, on account o the water being driven up against the bows, higher than the surroundin fluid, produced its effect.

The above named resistance equalled, it was found, about one-twelft

of the length of the body immersed; but which proportion must vary, however, with the speed.

The centre of gravity in all these experiments seemed to have little or no influence with regard to the centre of lateral resistance, it being regulated by the perpendicular surface exposed to the water; and the centre of which was the centre of lateral resistance when the force of the water acted at right angles to that surface.

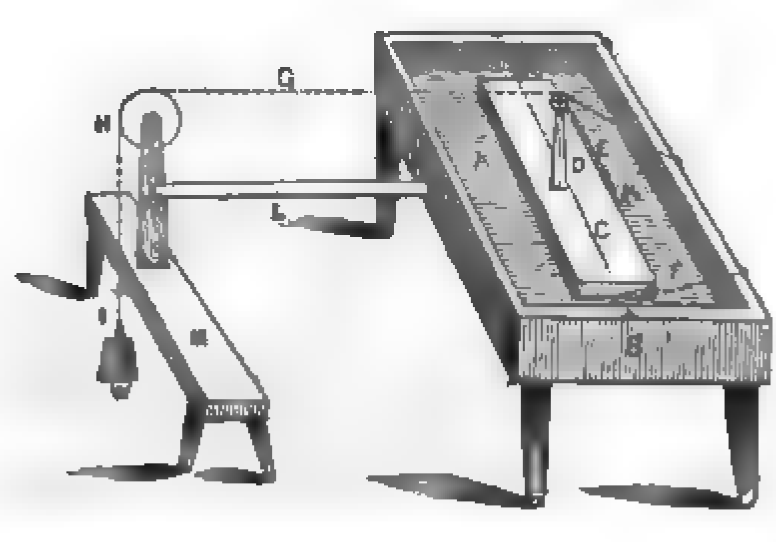
Chapter IV.—Of Stability and its Laws.

Experiments relative to the Law of Stability when the Width or Beam is increased.

For this purpose four pieces of deal were chosen, of the following dimensions:—

No.	Length.	Width.	Depth.	Weight.
1	15 in.	3 in.	2 in.	1 lb. 8 oz.
2	15 in.	4½ in.	2 in.	2 lb. 3 oz.
3	15 in.	6 in.	2 in.	2 lb. 13 oz.
4	15 in.	7½ in.	2 in.	3 lb. 7 oz.

In order to ascertain the stability of each respectively, as they in turn floated upon the water, a small movable mast, three inches high, having a hole through the top, was fixed on the upper surface, and in the centre of gravity; one end of a line was looped over a nail driven into the side of the wood, when the other end was first passed through the hole, then continued on over a pulley, and at the end a small bag was attached for the convenience of holding weights. Into the two extremities of the same piece of wood as No. 1, nails were driven lightly, and at the points where the centres of the wood cut the line of flotation. Over the heads of these nails a string of sufficient length was secured by two loops, the other ends of the strings being then made fast to nails driven into the side of the cistern of water, and at the water-level; but in the direction opposite to the string going over the pulley, with the view of counteracting the force of the weights.



A B the tank, and A, the surface of the water; C, the model; D, the mast through which the line E, G, H, I, passes, being first attached to the model by a nail at K; W, the height; M, the stool which carries the pulley; L, a shore to steady and support the pulley.

All being prepared, the weights were put into the bag until the s of the piece of wood opposite the pulley heeled down into the wate the depth of one inch, previously marked out; and by this means, scale, as will be presently given, was obtained.

Experiment 6.—*The Scale and Table* A.

No.	Length.	Width.	Depth or thickness.	Floating depth.	Stability.	Ratio.
1.	15 in.	3 in.	2 in.	1 in.	2 oz.	1
2.	15 in.	4½ in.	2 in.	1 in.	7 oz.	3½
3.	15 in.	6 in.	2 in.	1 in.	14 oz.	7
4.	15 in.	7½ in.	2 in.	1 in.	22 oz.	11

The conclusions to be drawn from this scale are, that with the sa length the ratio of stability is at its limit of rapid increase when the widt just one-third of the length; or, as 5 : 15 (see No. 2,) being nearly in cubic ratio. Afterwards, it approaches to the arithmetic ratio.

With respect to the centre of gravity of the four pieces of wood e ployed upon the occasion, it is right to state they were cut from the sa plank of timber, which had been selected on account of its appar uniform density. And the models, when put on the water, all sunk do to the middle of their thickness, or just one inch out of the two; con quently, their centres of gravity were exactly level with the surface of water.

Experiments to ascertain the Law of Stability as regards the Increase Length, the Width and Thickness of the Floating Bodies being constan

For this purpose, six pieces of wood (deal) were employed, and of under named dimensions and weights.

Experiment 7.—*Scale and Table* B.

No.	Width.	Length.	Weight.	Stability.	Ratio.
1.	3 in.	3 in.	1⅜ oz.	¼ oz.	1
2.	3 in.	6 in.	2⅝ oz.	¾ oz.	3
3.	3 in.	9 in.	4 nearly	1⅛ oz.	4
4.	3 in.	12 in.	5⅜ oz.	1⅜ oz.	5
5.	3 in.	15 in.	7 oz.	1⅝ oz.	6
6.	3 in.	18 in.	8¾ oz.	1¾ oz.	7

Here the scale of increase is as 1 : 3 when the length is doubled ; l after this it takes the arithmetic ratio.

Further Experiments to determine how the Law of Stability operates wi the Length and Width of Floating Bodies are constant, the Height Thickness alone being varied.

The following were the dimensions of the models of deal selected:

Experiment 8.—*Scale and Table* C.

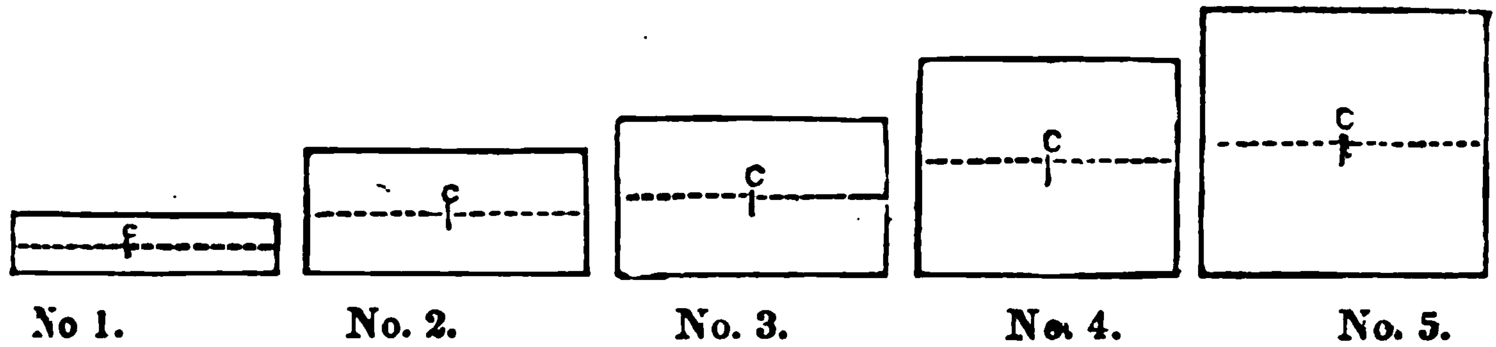
No.	Width.	Length.	Thickness.	Weight.	Stability.	Ratio.
1.	3 in.	9 in.	⅝ in.	4 oz.	1¼ oz.	2½
2.	3 in.	9 in.	1¼ in.	8 oz.	1¾ oz.	3½
3.	3 in.	9 in.	1¾ in.	12 oz.	1½ oz.	3
4.	3 in.	9 in.	2¼ in.	16 oz.	1 oz.	2
5.	3 in.	9 in.	3 in.	20 oz.	¼ oz.	½*

* Or next to nothing, being a cube.

In this table it is seen that when the thickness is in the proportion of 5: 12 of the width (as in No. 2,) or the depth of flotation one-fifth, say, of the beam, and the centre of gravity at the water level, the stability is at its greatest.

And further, that 4 oz. in weight placed low (as in No. 1 of this table,) more than counterbalances 16 oz., as in (No. 4,) when situated high.

Midsections.—C, the centre of gravity and line of flotation.



Scale ¼-inch to 1 inch.

If these three tables be admitted as correct, it establishes the rule, that the line of flotation, with regard to depth, and as it affects stability, should be one-fifth of the breadth of the beam, when the body partakes of the parallelopiped form; the centre of gravity being preserved at or just within the level of the surface of the water of the floating body.

Let it be here repeated, relative to all the above experiments, that each piece of deal sunk in the water to half its depth or thickness; therefore, their respective centres of gravity were always on a level with the surface of the water.

To be Continued.

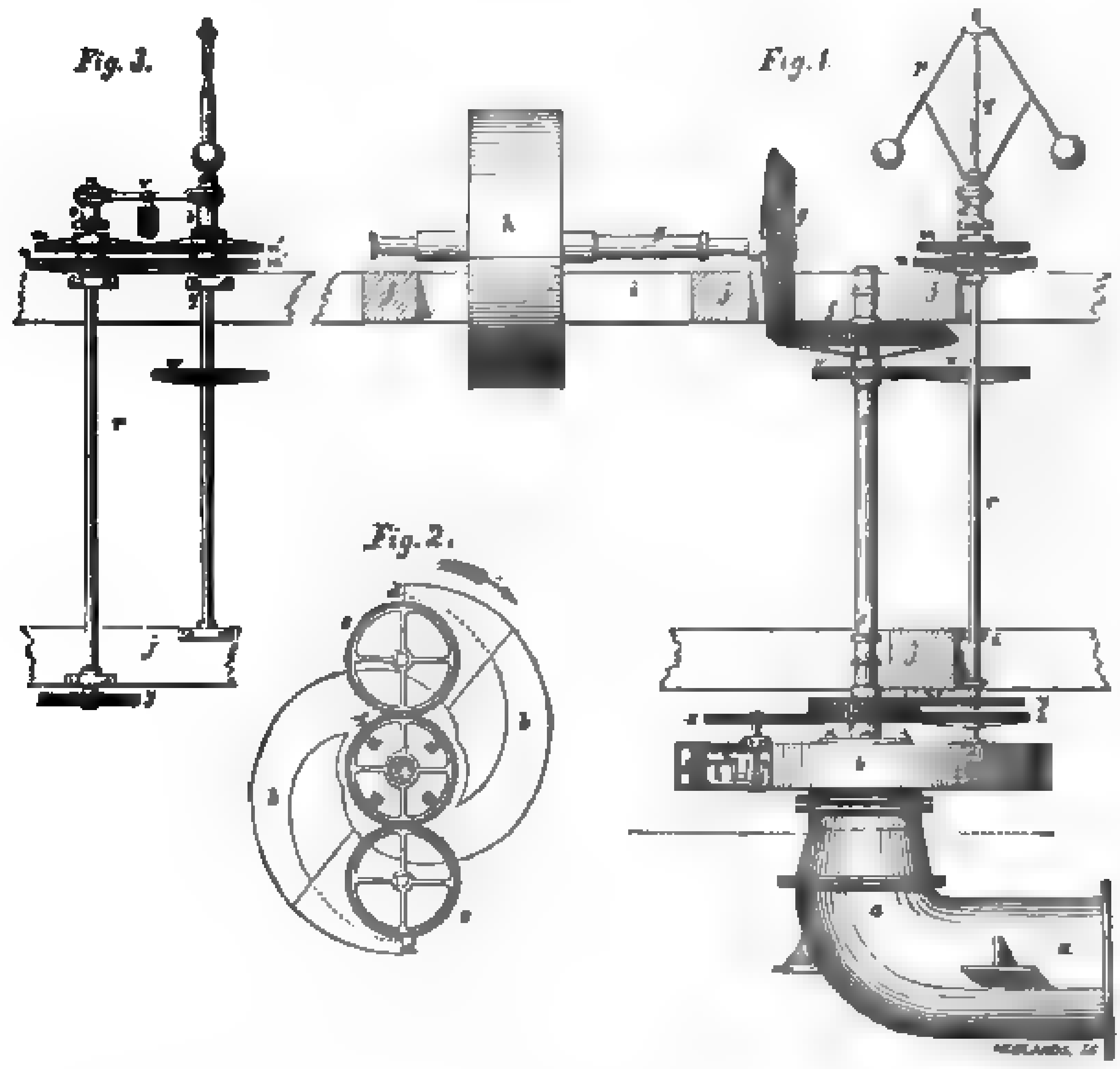
For the Journal of the Franklin Institute.

Launch of the Royal Mail Steamship Arabia.

On Wednesday last one of the new and splendid steamships, belonging to the British and North American Company's line, which have been in course of building at Greenock for some months past, was launched in the presence of a vast concourse of spectators. She is called the *Arabia*, and will be commanded by Capt. Judkins, now of the *Asia*, the veteran Commodore of the British and North American fleet of steamships. Her length is 310 feet; burthen upward of 2400 tons; and she will be fitted up with 2 side lever engines of 1000 horse power; diameter of each cylinder, 103 inches, by 10 feet stroke. The regularity and precision which have so long characterized the *Asia*, the *Europa*, and the other steamships belonging to the British and North American line, reflect the highest credit on their commanders, agents, and all parties concerned. The punctual launch of the Arabia before the close of the present year, as promised, is hailed by the shipping interest on this side as another guarantee for the continuance of that promptitude which has earned for the British North American Company and its spirited agents, Messrs. M'Iver & Co., so distinguished a reputation.

Description of a Regulator or Governor for Water Wheels. Patented by MR. JAMES FINLEY, *of Cold Spring, Putnam County, New York.*

Fig. 1 is a side elevation of Finley's Patent Differential Governor, as applied to Whitelaw & Stirratt's patent Water Wheel. Fig. 2 is a plan of the gearing on the top of the water wheel, in connexion with the governor; and fig. 3 is a front elevation of the governor, apart from the water wheel. In which figures the same letters refer to the same parts.



b b is the water wheel, *d d* the jet apertures, *a a* the main pipe, *e* the water wheel shaft, *f f* the main gearing, by which the power is transmitted to the main shaft, *g*, and drum, *h*, and from thence by a band to any machinery on which it may be intended to act. *i i* and *j j* are parts of the framing. *p* is a revolving pendulum, mounted on a spindle, *q*, which in the view shown, fig. 1, is situated beyond a second spindle, *r*, as seen in fig. 3, and is supported by a step on the upper edge of the lower frame, at *i*. This spindle is driven from the water wheel shaft by the cog wheels, *w w*, and carries two cog wheels, *m′ n′*, of different sizes, which gear into two similar cog wheels, *m n*, on the spindle *r*. These wheels are reversed in position, so as to have the smaller on the one spindle, to gear into the larger on the other. *n′* and *n* are keyed fast. *m′* and *m* are

loose, but are capable of being engaged by the cluth boxes, *o* and *k*; the prongs of the latter being sufficiently long to engage *m'*, by extending down through betwixt the arms of *n'*. This clutch box is connected by links to the arms of the revolving pendulum, so as to be drawn upwards or pushed downwards, in accordance with the centrifugal action of the balls, consequent upon the variations of motion; and it is also connected with the clutch box *o*, by a double forked lever, movable on the centre *v*. The result of this connexion being to communicate to the clutch box *o*, the upward and downward motion given to the clutch box *k*, by the arms of the revolving pendulum. The motion thus communicated will be seen to be in opposite directions; the one clutch box moving upwards, whilst the other is moving downwards, and vice versa. *x* is a cog wheel, fitted loosely to a turned seat on the shaft *e*, so as to be at liberty to revolve freely round, independent of that shaft. It is connected through an intermediate stud wheel, *z z*, with a wheel *y*, which is keyed fast on the bottom of the spindle, *r*, and consequently must partake of any variation of motion that may be given to that spindle. *s s* are cog wheels which gear also into *x*, below *y* and *z*. These wheels are mounted on short spindles, which revolve in bearings attached to the water wheel, and have screws formed on the lower end; one of which is seen at 2, fig. 1. On this screw there is a nut with two projecting ears, which are embraced by the forked end of the horizontal arm of the bell crank, 1; the vertical arm of which is connected by the link, 4, with a movable adjusting plate, which forms the inside of the jet aperture at *a*. It will now be obvious, that if the cog wheel, *x*, be made to revolve in either direction, the wheels, *s s*, with their spindles, will revolve accordingly; and by the action of the screws, the nuts held by the forked ends of the bell cranks will either ascend or descend, in accordance with the direction of the motion given to *x*; and will act on the adjusting plates through the agency of the bell cranks and links, so as either to push them outwards, and diminish the width of the jet apertures, or draw them inwards, and increase that width.

Such being the general arrangement of the parts of the governor, its action may be thus explained. Assuming 37 revolutions per minute to be the proper speed of the water wheel, and also the proper speed for the revolving pendulum; let it be supposed that the water wheel having been put in operation, is making 37 revolutions per minute; it will transmit the same speed to the spindle of the revolving pendulum through the equal sized cog wheels, *w w*, and draw up the clutch box, *k*, and also the double forked lever in connexion with it, to the exact position at which they will stand under those circumstances. But by the same action the fork on the opposite end of the lever will push down the clutch box, *o*, on the spindle, *r*, to a corresponding distance. In this state of things the lever is supposed to stand in a level position, holding both clutch boxes out of gear with their respective loose wheels, *m'* and *m*, as represented in fig. 3. It will be obvious that no motion can in this case be transmitted from the spindle, *q*, to the spindle, *r*, and consequently no motion can be transmitted to the wheel, *x*. So long therefore as this state of things continues, no change can take place in the widths of the jet apertures.

Suppose now a part of the resistance to be thrown off the water wheel;

the speed will then begin to increase; but the moment that this takes place, the balls of the revolving pendulum will by their increased centrifugal action recede further from the centre of motion, and raising up the clutch box, *k*, will push down the clutch box, *o*, so as to engage the wheel, *m*. The consequence will be, a speed transmitted through the spindle, *r*, to the wheel, *x*, as much greater than the speed of the water wheel, as the wheel, *n'*, is larger than the wheel, *m*. But the wheel, *x*, being free to move, independent of the water wheel shaft, and being driven in the same direction, will have a relative motion round that shaft precisely equal to this difference of speed. For instance, should this difference be five revolutions per minute, the wheels, *s s*, will each make five revolutions per minute; which acting through the arrangement of parts already explained on the adjusting plates at *d d*, will communicate to them an outward motion, tending to increase the width of the jet apertures, and this action will continue until the water wheel resumes its proper speed; when the lever and clutch boxes will return to their former position, until another change of resistance calls for a renewed action of the governor.

Let it now be supposed that the resistance taken off, has been again put upon the water wheel, and it will be seen that an action precisely similar to what has been already described will take place, but in a contrary direction. The wheel, *x*, will then have a relative motion in a contrary direction to the motion of the water wheel, and an action will consequently be transmitted to the adjusting plates, to draw them inwards, and increase the width of the jet aperture.

---

*Photography on Glass.**

Having lately had my attention drawn to the system of obtaining photographic pictures on glass, I was led, by the simplicity of the process, to make some experiments upon it, in the course of which I have succeeded in still further simplifying it. As it is highly probable that many of your readers are interested in this, as well as other branches of photography, I subjoin a description of my modifications. I shall, however, in the first place give a sketch of the mode of operating which I believe is generally adopted by amateurs as being the simplest, for the benefit of such of your readers as may be still unacquainted with this interesting and beautiful process. It is as follows:—Having precipitated an iodide of silver from a solution of its nitrate, by adding to it a solution of iodide of potassium till it is re-disolved. A little of this solution of iodide of silver is then to be added gradually to collodion (a description of which is given below,) and well shaken with it. After settling, this mixture is ready for use. Having procured a piece of plate-glass of the size required, pour over it some of the *iodized* collodion, allowing it to spread over the surface of the glass, so as to cover it completely; and then to flow off at one of the corners. After a little practice, this becomes very easy, and a fine even coating is obtained. The iodized plate is now to be immersed in a solution of nitrate of silver, 30 grains to the ounce of water, till the

* From the Glasgow Practical Mechanic's Journal, December, 1851.

solution flows evenly over its surface, and it is then ready for the camera. After removal from the camera, the picture is developed by pouring over it some of the following mixture:—

Pyro-gallic acid, ...	3 grs.
Glacial acetic acid, ...	1 drm.
Water, ...	1 oz.

When the picture is sufficiently developed, it is first washed with water, and the sensitive coating is removed by means of a strong solution of hyposulphite of soda. It is then to be washed again with water, and when dry, a little thin varnish may be poured over it, to protect it from being rubbed off.

I now come to describe the modifications which I have adopted, and which I find not only simpler, but productive of a better result than can be obtained by the process which I have described.

The first of these relates to the iodized collodion, and was suggested by the idea, that it was unnecessary to add iodide of *silver* to the collodion, as the addition of iodide of potassium *alone*, on immersion in the nitrate of silver, would form the required coating of iodide of silver upon the glass. On trial I found this to be the case.

At this point it may be well to make some remarks regarding the preparation of the collodion, which is of so much importance in this process. It is made, as is now generally known, from gun cotton dissolved in sulphuric ether. There is, however, considerable difference in the mode of preparing the cotton for this purpose. I find the most certain mode of obtaining very soluble cotton, is to make use of nitric acid. Equal bulks of sulphuric acid and nitre will be found to answer very well. Let the cotton be immersed in this mixture, and well saturated with it for about seven or eight minutes; then let it be taken out, and thoroughly washed in water, and dried.

We now arrive at the iodizing process, which may be simply effected thus:—To *pure* sulphuric ether add about ⅛th of its bulk of alcohol, then a little iodide of potassium, and after this the prepared cotton; let these be well shaken together for some time, and then allowed to settle. Four or five grains of iodide to the ounce of ether will be found sufficient.

The admixture of alcohol to the ether seems to be necessary in preparing collodion for our present purpose, as it will be found, if *pure* ether be employed, that little or no coating will be formed on immersion in the nitrate of silver. It must, at the same time, be observed, on the other hand, that when too much alcohol is added, the coating will be too opaque, preventing the light from penetrating. Thus, little more than the surface of the sensitive coating being acted upon, it is impossible to obtain a bold picture. It is difficult, by description, to point out the depth of coating required, but a very little experience will be sufficient to determine this. The object is to avoid the extremes above mentioned, viz., the having little or no coating at all, and the having a coating too opaque.

From the difficulty I have experienced in always obtaining *pure* ether, (there being often a considerable quantity of alcohol already mixed with it,) I have been obliged to adopt the following mode of preparing iodized collodion. To 1 oz of ether add 5 or 6 grs. of iodide of potassium, and

shake them well together for some time; after settling, the iodized ether should be poured off, and some of the prepared cotton added to it till the proper consistency is attained. Now, prepare a solution of iodide of potassium in alcohol, and add this to the iodized collodion till the coating formed by immersion in the silver solution is considered sufficiently deep. This should be of a milk-like appearance, but at the same time considerably transparent, for reasons before given. By this means, I am enabled with ease, to modify my collodion so as to obtain any depth of coating I may desire; the only objection attending this *adulteration* being, the having to pay the price of ether for so much alcohol, which every one knows is considerably cheaper. My next modification is in the preparation of the developing mixture. It will be noticed that pyro-gallic acid is recommended for this purpose, the acetic acid being added to prevent the pyrogallic from attacking the parts unaffected by light. This, in common with most other acids, it effects; but I have never been able by its use to obtain a pure white. From this circumstance, I was led to try the effects of other acids, and found nitric acid to answer my purpose. A difficulty, however, arose in the nice adjustment required in the proportions of the two acids, which induced me to try another well known developing agent, sulphate of iron, and the result obtained in this way was quite satisfactory. The proportions in this case seem to be of much less importance, so that, with very little care, an excellent developing mixture may be obtained. I subjoin the proportions which I have used with success:—

Sulphate of iron, ...	12 grs.
Nitric acid, ...	1 or 2 drops.
Water, ...	1 oz.

If, from any variation in the strength of the nitric acid, the dark parts of the picture should be spoiled by the action of the sulphate, the addition of a little more acid will be found to prevent the evil.

By means of the above modifications, I have obtained some excellent results; the whites of the picture being very pure, and of a fine metallic appearance, much resembling frosted silver. H. R.

Glasgow, November, 1851.

[We have before us some examples of our correspondent's productions, which possess an amount of brilliancy and boldness unknown in the ordinary Daguerreotype process. Few modern arts can be said to be in a state so essentially transitionary as Photography; but the introduction of glass seems to promise, in its results, to throw all previous inventions into the shade.—Ed. P. M. Journal.

For the Journal of the Franklin Institute.

Trial Trip of the U. S. Steamship "Fulton." By Chief Engineer, B. F. Isherwood, *U. S. Navy.*

Most persons who feel interested in matters of steam navigation, will remember the old U. S. steamship *Fulton*, built about 14 years ago at the Brooklyn Navy Yard, where she has lain since that time a perfect specimen of an utter failure. She was constructed for a war sea steamer, with

which view she was fitted with two horizontal condensing engines of 50 inches diameter of cylinder, by 9 feet stroke; *the engines being placed on the spar deck; each engine working its own paddle wheel independently*, the main shaft not extending across the vessel. Such were the arrangements by which it was contemplated to make a marine war steamer fourteen years ago; the machinery wholly exposed on deck to shot, and rendered almost useless at sea by the absence of connexion between the paddle wheels, so that when one was deeply immersed by the careening of the vessel, and its engine brought to a stand by the increased resistance thrown upon it, the other, being by the same operation so relieved of its resistance that its engine would spin it around with a velocity threatening the destruction of the machinery. Moreover, this well appointed sea steamship carried fuel but for three or four days' moderate steaming. The *Fulton* was also fitted with old fashioned cumbrous *copper* boilers.

In January, 1851, the Chief of the Bureau of Construction, Equipment, and Repair of the Navy Department, (Commodore Chas. Wm. Skinner,) directed the present Engineer in Chief of the Navy, (Gen. Chas. B. Stuart,) to entirely reconstruct the machinery of the *Fulton*, so as to make an efficient war steamer of her, with high speed, and capable of carrying a large amount of fuel. A contract was accordingly made with Mr. H. R. Dunham, of New York, and all the parts of the old engines that could be used were employed; new iron boilers were constructed, and the old copper ones being sold, contributed principally to defraying the cost of the new work.

With regard to the hull, no alterations were made except to the bulwarks on the spar deck, and to the internal arrangements. The model of the hull is peculiar; the two halves from the amidship section being precisely alike and having the water lines full; a model in all respects considered very unfavorable for speed. It was not changed, however, from motives of economy.

The vessel as now finished, together with the machinery, has the following dimensions:

HULL.

Length between perpendiculars,	180 feet
Extreme beam,	34 " 9 inches.
Depth of hold,	12 "
Burthen,	750 tons.
Draft of water on trial trip, forward,	9 feet 6 inches.
Draft of water on trial trip, mean,	10 "
Draft of water on trial trip, aft,	10 " 6 "
Immersed amidship section on trial trip,	298 square feet.
Displacement per inch of draft, at 10 feet draft,	8½ tons.
RIG.—Fore top-sail schooner.	
Fuel carried on trial trip,	220 tons anthracite.
Fuel carried with bunkers and bags filled,	275 "

ENGINE.

One condensing inclined engine.

Diameter of cylinder,	50 inches.
Stroke of piston,	10 feet 4 "
Space displacement of piston per stroke,	140·9 cubic feet.
Square feet of immersed amidship section per cubic foot of space displacement of piston per stroke,	2.115 "
Square feet of immersed amidship section per cubic foot of space displacement of piston per stroke, multiplied by number of strokes (20) *per minute*,	0·106 "

Paddle Wheel.

Overhung side paddle wheels of the common radial kind.

Diameter of wheel from outside to outside of paddles,	24 feet
Length of paddles, ...	7 " 9 inches.
Breadth of paddles, ...	1 " 6 "
Dip of paddles on trial trip, ...	3 " 8 "
Number of paddles in each wheel, ...	20
Areas of two paddles, ...	23·25 square feet.
Proportion of the areas of two paddles to immersed section of hull, ...	1·000 to 12·817

Boilers.

Two iron boilers of the double return drop flue variety.

Diameter of shells (circular shells from end to end,) .	10 feet 6 inches.
Length, ...	24 "
Grate surface, (both boilers,)	112 square feet.
Heating " " "	2600 "
Proportion of heating to grate surface, . 23,214 to 1000	"
Proportion of heating surface per cubic foot of space displacement of piston per stroke, ... 18,453	"
Proportion of heating surface per cubic foot of space displacement of piston per stroke, multiplied by number (20) of double strokes of piston per minute, . . 0·923	"

The boilers are provided with two fan blowers, 48 inches diameter, to be used if necessai
On the trial trip, it was impossible to ascertain with any exactness, what the consum tion of coal was during the steaming.

Performance.

The vessel was tried in New York harbor and outside the Hook, Ja uary 1st, 1852. I have taken from the engineer's log of the trip, tl speed, steam pressure, revolution of the wheels, &c., between poin where they continued uniform, and the disturbing influences of wind an tide were but slightly felt or accurately ascertained. The results th obtained will show fairly the performance of the vessel.

At 11 h. 3 m. A. M., the flag staffs on Governor's Island and Cast William were in range; at 11 h. 29½ m., the flag staffs on Forts Lafayet and Hamilton were in line; time, 26½ minutes; distance per Coast Surve 6·75 statute miles; steam pressure in boiler, 25 lbs. per square inch, c off ¾ths stroke; vacuum in condenser, 25 inches of mercury; doub strokes of piston per minute, 22; tide slack; weather calm, shown by tl flags drooping on their staves.

Speed per hour by Coast Survey Chart, . .	15·283 statute miles.
" " log thrown on board, 13 knots of 6140 feet, or	15·117 "
Slip of the centre of reaction of the paddles, calculated for the 15·283 statute miles, ...	15·45 per cent.
Oblique action of the paddles, ...	16·64 "
Sum of the losses by the paddle wheel,	32·09 "
Mean effective pressure on the piston per square inch, calculated for an initial cylinder pressure 2 lbs. less than boiler pressure, and for a back cylinder pressure 2 lbs. greater than condenser back pressure, ...	32 pounds
Actual power developed by the engine, ...	868·7 horses.

In continuation; ran to S. W. Spit, and rounded the buoy at 12 h. 12 ı P. M.; time, 42½ minutes; distance, 9·25 statute miles; steam pressure boiler per square inch, 20 lbs., cut off at ⅝th stroke; vacuum in condens

25 inches mercury; double stroke of piston per minute, 19; wind and tide same as before.

Speed per hour by Coast Survey Chart, .	13·059 statute miles.
Slip of the centre of reaction of the paddles, . .	16·34 per cent.
Oblique action of the paddles, ...	16·64 "
Sum of the losses by the paddle wheel,	32·98 "
Mean effective pressure on the piston per square inch, calculated as before, ...	25½ pounds.
Actual power developed by the engine, . . .	595·77 horses.

In continuation; passed Sandy Hook at 12 h. 21 m. P. M.; distance, 2·00 miles; time, 9 minutes; steam pressure in boiler, 30 lbs. per square inch, cut off at ⅝th the stroke; vacuum in condenser, 25 inches; double strokes of piston per minute, 20½; light wind abeam, and ½ knot per hour head current.

Speed per hour by Coast Survey Chart, . .	13·333 statute miles.
To which add for current, ...	0·581 "
	13·914
Speed per hour by log thrown on board, . .	12⅜ knots of 6140 feet,
	or 14·201 statute miles.
Slip of the centre of reaction of the paddles calculated for the 13·914 statute miles, ...	17·39 per cent.
Oblique action of the paddles, ...	16·64 "
Sum of the losses by the paddle wheel, .	34·03 "
Mean effective pressure on the piston per square inch, callated as before, ...	34.07 pounds.
Actual power developed by the engine, . . .	874·72 horses.

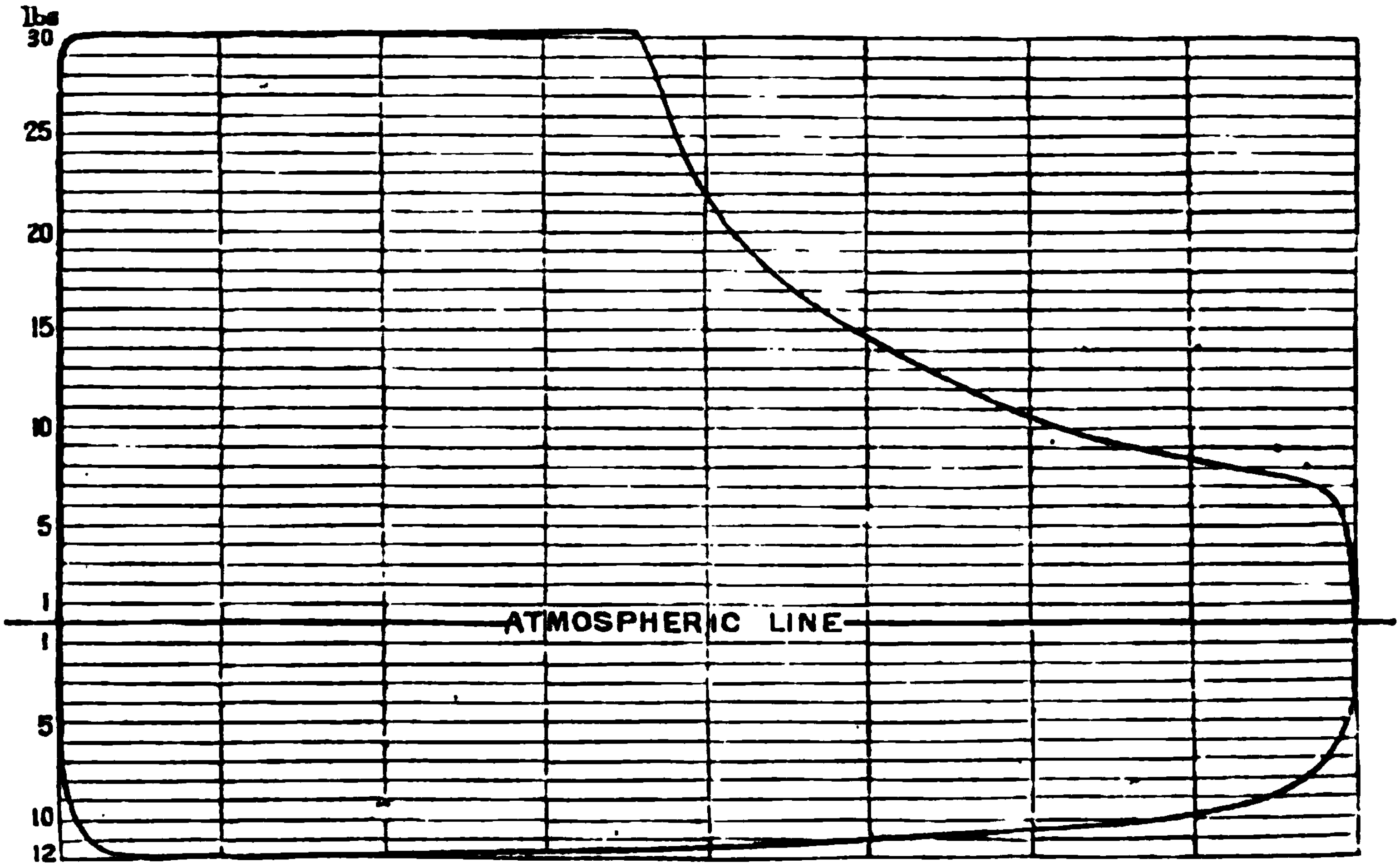
In continuation, ran, with a moderate sea on, (now steaming at sea,) to the Lightship, and was abreast of it at 1 h. 6 m. P. M.; moderate wind a little aft the beam; time, 45 minutes; distance, 8·25 miles; steam pressure in boiler, 27½ pounds per square inch, cut off at ⅝th the stroke; vacuum in condenser, 25 inches; double strokes of piston per minute, 20; wind on beam.

Speed per hour by Coast Survey Chart, .	11 statute miles of 5280 feet.
	or 9·459 knots of 6140 feet.
Slip of the centre of reaction of the paddles, .	33·06 per cent.
Oblique action of the paddles, ...	16·64 "
Sum of the losses by the paddle wheel,	49·70 "
Mean effective pressure on piston, calculated as before,	34·3 pounds.
Actual power developed by the engine, . .	843·55 horses.

It will appear from the foregoing, that the mean slip of the paddles in still water and calm weather, taken from the first two computations, is $\left(\frac{15{\cdot}45+16{\cdot}34}{2}\right)$ 15·895 per cent; and that the effect of a light wind abeam was sufficient to increase this slip to 17·39 per cent. in still water; while the effect of a moderate wind abeam, coupled with a moderate sea, increased the slip up to 33·06 per cent.

While at sea, the vessel was tried under canvass alone with a moderate wind on the quarter, when she made 4½ knots per hour, dragging the wheels, which were stationary. She was also turned under canvass alone, reversing the direction of her head in 5 minutes.

The accompanying indicator diagram is appended to show the working of the valves, &c.; the cut-off was Sickel's, and momentarily adjustable.



Steam pressure in boiler above atmosphere per gauge, 32 lbs.; vacuum in condenser, 25 inches of mercury; double strokes of piston per min., 22.

For the Journal of the Franklin Institute.

The Steam Navy of the United States now consists of

			In.		Ft.	
Mississippi,	Side Wheel,	Double Engines,	75	×	7	Refitting at Philada.
Susquehanna,	"	"	70	×	10	East India Squadron.
Powhattan,	"	"	70	×	10	Building at Norfolk.
Saranac,	"	"	60	×	9	Gulf of Mexico.
San Jacinto,	propeller,	"	62½	×	4⅙	Mediterranean.
Michigan,	side wheel,	"	36	×	8	Lake Erie.
Fulton,	"	Single Engine,	50	×	10½	Fitting out at N York.
Princeton,	propeller, double	"	56	×	3	" " Boston.
Water Witch,	side wheel, single	"	36	×	6	Repairs at Washingt'n.
Vixen,	" "	"	36	×	6	Gulf of Mexico.
Alleghany,	propeller, double	"	60	×	4	Repairs at Norfolk.

In addition to the above, there are several small steam vessels (tenders) at the several navy yards, that could, to some extent, be used as transports for moderate distances.

---

*The Holyhead Steamers.**

The most successful effort at producing fast steamers has resulted from the competition which the Board of Admiralty induced for separate designs for four steam packets, to occupy the station between Holyhead and Kingstown. The four constructors who submitted plans for these vessels

*From the Glasgow Practical Mechanic's Journal, for December, 1851.

ir Wm. Symonds, for the *Caradoc;* Mr. Oliver Wm. Lang, of m dock-yard, for the *Banshee;* Messrs. Miller and Ravenhill, for *wellyn;* and Mr. John Laird of Birkenhead, for the *St. Columba.* llowing table states the principal dimensions of these vessels, and me other information, showing their active and relative capabilities d.

PARTICULARS.	Caradoc.	Banshee.	Llewellyn.	St. Columba.
	ft. in.	ft. in.	ft. in.	ft. in.
between perpendiculars,	193 0	189 0	190 0	198 6½
h of vessel, . . .	26 9	27 2	29 6	27 3
h over paddle-boxes, .	—	49 6	—	43 6
in hold, ...	14 9	14 9	—	15 5
f water, forward, .	—	8 10	—	9 2
f water, aft, . .	—	9 2	—	8 7½
lisplacement in tons, .	260	270	323	272
n in tons, . . .	662	670	654	719
er of paddle wheels, .	25 6	25 0	30 0	28 0
al horse power of engines,	350	350	350	350
ter of cylinder in inches, .	74	72	68	70
of stroke, . . .	6 0	5 6	4 4	5 6
tions per minute, . .	28	30	27	25½
h of paddle wheel, . .	8 0	9 0	8 6	6 0
paddle wheel, . . .	—	5 6½	—	5 6½
f paddle wheel, . .	—	33 9	30 10½	27 0
f the midship section, .	—	190 0	—	—
	h. m. s.	h. m. s.	h. m. s.	h. m. s.
occupied in making shortest age between Holyhead and stown, from 1st Aug. to Dec., 1848,	4 0 0	3 26 0	3 41 0	3 56 0
knots per hour, . .	14·0	16·32	15·2	14·23
miles per hour, . .	16·13	18·80	17·5	16·37
of longest passage, . .	5 52 0	5 23 0	5 28 0	6 23 0
knots per hour, . .	9·5	10·4	10·24	8·77
miles per hour, . .	10·94	12·0	11·79	10·10
e time of passage, .	4 30 0	4 2 48	4 15 30	4 38 48
knots per hour, . .	12·45	13·84	13·10	12·05
miles per hour, . .	14.34	15·95	15·10	13·00
	lbs.	lbs.	lbs.	lbs.
re on the safety valve, .	14	14	20	14
	h. m. s.	h. m. s.	h. m. s.	h. m. s.
of making shortest passage 1st Jan. to 1st March, 1849,	3 59 0	3 36 0	3 37 0	4 8 0
of longest passage, .	5 16 0	7 43 *0	4 50 0	6 30 0
e time of passage in 1848-9,	4 31 25	4 3 8	4 9 30	4 40 42
t time of passage, from 1st to 1st Oct., 1849,	3 54 0	2 26 0	3 36 0	4 3 0
e time of passage, from 1st to 1st Oct. 1849,	4 26 0	4 3 0	4 6 0	4 40 0

ordinary performances of these four packets, as well as their per-nces especially under trial, have determined their relative merits. service is one that demands at all times the greatest effort that can de; and therefore it is no doubt quite fair to conclude that they done all that they are capable of doing, and that the following order rit is strictly correct: *Banshee*, first; *Llewellyn*, second; *Caradoc*, *St. Columba*, fourth. It will be observed that the pressure of steam

s passage was made in a state of weather so bad, that no other steam packet d to attempt it on that day.

kept up was the same (14 lbs. on the valve) in all except the *Llewellyn*, in which it was 20 lbs. Sufficient time has elapsed to sanction the inference thus drawn of relative excellence as to speed, whilst there is no doubt that each of them bears a character of very high order.—*Fincham.*

Remarks on the Propeller Steamship S. S. Lewis.

This propeller steamship has recently arrived in Boston, after a passage of about 24 days from Liverpool, 20 of it being expended in reaching Halifax, where she arrived short of fuel. It will be remembered that this vessel was constructed in this city during the past season, and was sold to a Boston house, to run from thence to Liverpool. She left there some time during the month of November, and made the passage to within 300 miles of her destination in 11 days, when she broke the blades of her propeller, and was obliged to finish the trip under canvass. On reception of this news, we were informed that she had made this passage *against* head winds and gales; and although every steamer that arrived from Liverpool, reported strong westerly winds, which are unusual at that season of the year, yet we find from the reports of the Lewis, that with her the winds were from the east; a most singular phenomenon, to which I respectfully call the attention of Lieut. Maurey. Very soon after the arrival of the Lewis at Liverpool, the following card appeared in the Public Ledger of this city:

Propellers vs. Side Wheels.

Messrs. Editors—After waiting in vain for some days for some abler pen than mine to notice the great triumph of the "Propeller," in the case of the unprecedented passage of the "S. S. Lewis," I have determined that it should not pass without remark. I say passage, for although some three hundred and odd miles were yet to be accomplished at the time she was disabled, yet it would be fair to infer that during another twenty-four or thirty hours she could have reached her destination, had she not met with the accident. Now, what will the advocates of side wheels say to a ship of her size and limited power, on her first trip, against head winds and gales, making the passage short of twelve days? Is it irrational, under the circumstances, to look for her to cross the Ferry in ten days, after making a few trips, and getting every thing in proper trim? I think not; and I am still more confirmed in my oft expressed opinion, that one-half the power lavished on the side wheel ships would be sufficient to keep up their present speed, were they altered to propellers. The time is coming, I predicted years ago, when we will wonder at the excessive prejudice which has led to squandering millions of dollars.

Now, gentlemen, I have a small crow to pick with the worthy members of the press. Is it their excessive modesty which leads them to overlook all home-made productions as soon as removed from the limits of our village? If this feat had been performed by a British ship, all England would applaud, and we would re-echo their laudations. If the "Lewis" had been a New York, Boston, or Baltimore ship, the news of her trip would have been paraded with encomiums in every newspaper far and near. Why cannot or will not the conductors of the Philadelphia press give the praise that is fully due our excellent mechanics, and our enterprising fellow citizen, R. F. Loper, the projector and builder of the "S. S. Lewis?" Certainly they all deserve it, and a feeling of gratified pride would be no small incentive to new and superior productions. M.

And it is with this article that I have to do. I wish to show to the citizens of this city that every exaggerated statement of this kind does us an injury, and that a proper regard for truth is essential even in reports of steamers, a point where I believe it is not generally expected to be found to any great extent.

In examining the above article by M., it will be observed that he states in effect as follows:

1st, That the Lewis is a large ship with small power.

2d, That if she had not broke her propeller, she would have made the passage in twelve days, against head winds and gales.

3d, That she *will* cross the Ferry, as he calls it, in ten days.

4th, That half the power lavished on side wheel steamers would enable them to maintain their present rates of speed, if they were altered to propellers.

He then gives it as his opinion that the time is coming, which he has often predicted, when we shall wonder at the excessive prejudice which has led to squandering millions of dollars, (on side wheel steamers I suppose he means.) Now, the man who deceives himself is to be pitied, but he who deceives others deserves no such consideration. To which class does M. belong?

The following statements are founded on fact:

1st, That the Lewis has as much power as most side wheel steamers of her tonnage, for she has two boilers, 21 feet long, 11 feet 6 inches wide, and 11 feet 2 inches high, containing full 5600 feet of fire surface; and as she is only about 1150 tons Custom House measurement, it follows that she has nearly 5 feet of fire surface per ton, while there is not a side wheel steamer out of the port of New York, having boilers of *similar* character, that has as great a ratio; they usually have from 3 to 4 square feet per ton. The amount of boiler that a steamer has is the measure of her power.

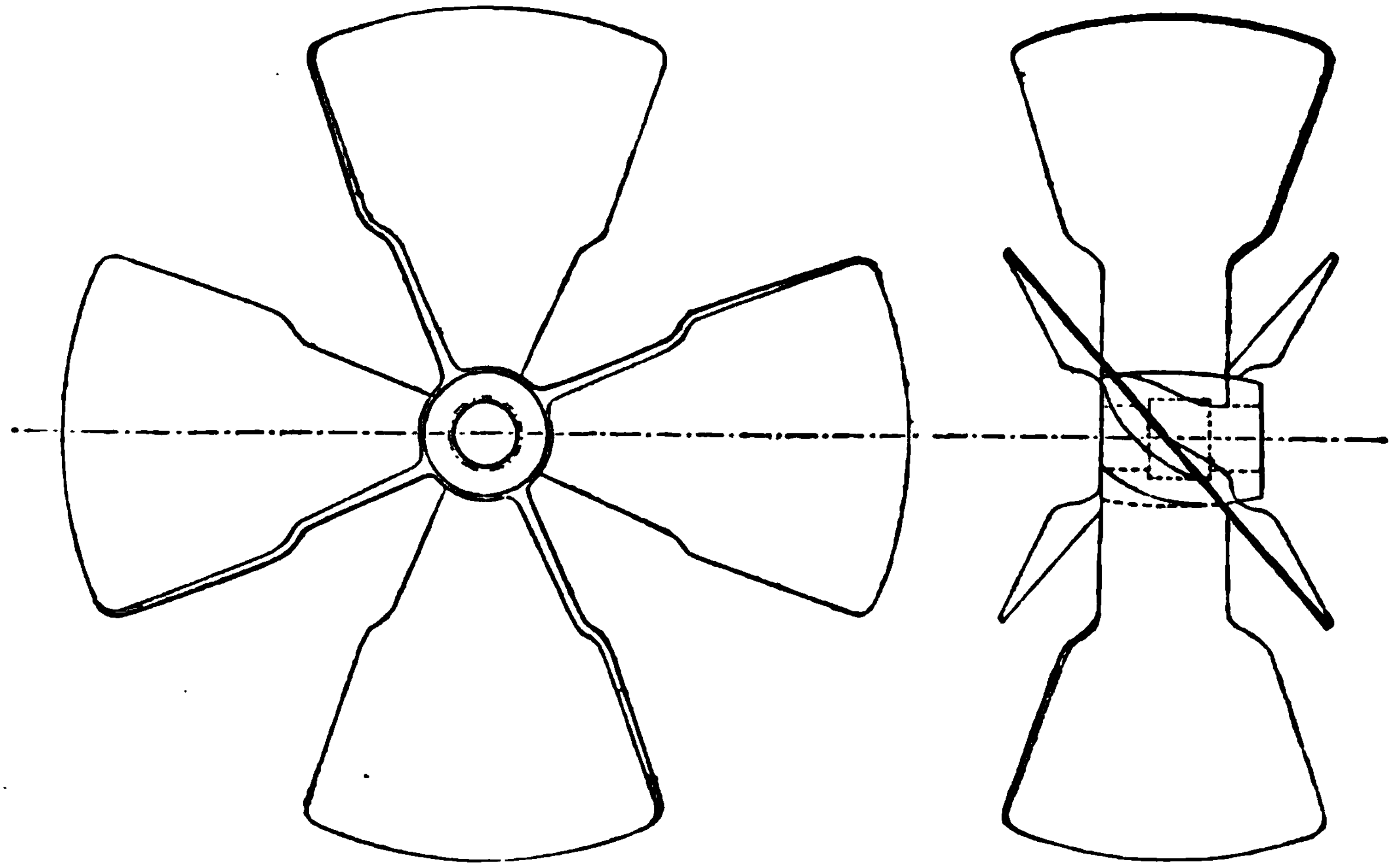
2d, I say she did not have head winds and gales during *the whole* of her passage, or any considerable portion of it; for the reason that every steamer coming westward, reported heavy head winds, (which usually prevail at that season of the year,) and the wind does not blow in two opposite directions at the same time; and also because on her return trip, when there is no question but the wind was ahead, she was 20 days in reaching Halifax. Now, both accounts cannot be correct, (the latter we know is,) or the easterly gales and head winds do not compare with those from the west.

3d, She will not cross *the Ferry* in 10 days, for she no doubt did her best on the first trip, and that would not have been done in 12 days, even without accident.

4th, Half the power of a side wheel steamer put into a propeller, would not enable her to be equal in speed to the former; on the contrary, no propeller can be found, having equal power, that can maintain equal speed to a side wheel steamer at sea, and no line of propellers can be found running in successful competition with side wheel steamers. By successful competition, I mean making as good time, or obtaining as high rates of freight and passage money.

The City of Philadelphia has for the past few years been noted for the number of propellers that have been built here, through the enterprise of one of her most active citizens; they are rightly considered a valuable addition to our merchant or naval service, and I have no wish to say aught against them. But I am utterly opposed to that system which makes every man a hero, or every propeller a Pacific; modest merit does not blow its own horn.

The dimensions of the S. S. Lewis are as follows:—Length, 225 feet; beam, 32 feet; depth, 27 feet; and in addition, a house on deck, which is too great a depth for her beam, and would have a strong tendency to make her top-heavy without ballast, and no successful steamer can be found that requires ballast.



Scale, 3-16 in. to one foot.

Her engines are two in number, connected at right angles. Diameter of each cylinder, 60 inches; length of stroke 40 inches. The crank shaft carries a large spur wheel, which gears into a pinion on the propeller shaft, and drives the latter 1¾ revolutions to 1 of the former. The propeller is of cast iron, of the following dimensions and form:—Diameter, 13 feet; angle at hub, 30°; angle at periphery, 50°; pitch at periphery, 34 feet; pitch at hub, 11 feet. FULTON.

---

*Improvements in the Manufacture of Gas.**

The competition which has of late years sprung up in the supply of the important article of gas to the inhabitants of the large towns of the United Kingdom, has not existed long without the production of one of its legitimate effects. It has drawn the attention of parties skilled in the chemistry of gas manufacture, and careful observers of the circumstances under which the best results are obtained, to the study of improved methods of treating the various substances capable of being used in the production of gas; and the first fruits are visible in the process lately patented by Messrs. Barlow and Gore, which, in the opinion of some of our most experienced gas engineers, is destined to produce a speedy revolution in the manufacture of gas, and materially to diminish the cost of its production.

The processes are based, 1st, Upon an improved method of rendering luminous the gases resulting from the perfect decomposition of water or steam; and, 2d, Upon the conservative influence which hydrogen exer-

*From the London Mining Journal, No. 845.

cises in protecting the matter upon which the illuminating power of gas depends from decomposition by heat.

The first has been attempted by Donovan, Manby, White, Webster, and others, with dubious and disputed success. Their failures are all traceable to the same sources—first, to the impossibility of insuring the complete decomposition of the water or steam by any of the means employed by them, and to the consequent production of a large quantity of vapor, exercising a fearfully destructive influence over the carbonaceous matter undergoing decomposition for the purpose of rendering the water gases luminous; and, secondly, to the presence in the water gases of from 10 to 15 per cent. of carbonic acid, the injurious effects of which upon the flame need not be here further alluded to, and the expenses of abstracting which by any of the ordinary methods are so considerable as materially to augment the cost of manufacture, besides diminishing the volume of saleable gas. The present patentees propose to obviate these difficulties by first *condensing* the water gases, so as to deprive them of all excess of vapor, and then to pass them through a heated retort containing carbonaceous matter, by which the whole of the carbonic acid gas will be converted into twice its bulk of carbonic oxide gas, and the pure hydrogen and carbonic oxide gases in equal volumes, free from carbonic acid, are afterwards admitted in regulated quantities into retorts where carbonaceous matter is undergoing distillation or decomposition, and by which they are rendered highly luminous. The conservative effect of hydrogen upon olefiant gas has not, we believe, hitherto been noticed by chemists. It may, however, be demonstrated by the following very simple experiment:—If olefiant gas be passed through a red-hot tube, the carbon will be deposited, and the gas be thereby converted into light carburetted hydrogen, a gas of very low illuminating power. If, however, hydrogen be added to the olefiant gas, the same process may be repeated without causing any deposition of carbon, and with only a diminution of illuminating power in the mixed gases, due to the increased volume of the non-illuminating gas—hydrogen.

The practical effect of this property, when applied to gas making, is to reduce the quantity of condensible products, such as tar, &c., and entirely to prevent the deposit of carbon on the interior surfaces of glass retorts.

The importance of these discoveries will be readily understood, when we state that the experience of the patentees leads them to the conclusion that upwards of fifty per cent. may be added to the volume of gas yielded by all descriptions of materials ordinarily used for that purpose, without any diminution of the illuminating power, so that 15,000 cubic feet will be the probable future produce from one ton of Newcastle coal, and 75,000 cubic feet of London gas from the same quantity of Boghead Cannel, the ashes from which are further stated to be the best material known for the manufacture of alum; the residue, after the abstraction of the alumina, being also valuable for the manufacture of pottery, porcelain, and glass, and as a dentifrice, a polishing powder, and decolorant—truly we live in an age of invention and wonders. We may add that the Chartered Gas Company of London, the patriarch of gas companies, have agreed with the patentees for licenses to use the processes at all their works.

For the Journal of the Franklin Institute.

On the Friction of Marine Engines. *By* J. V. Merrick.

In the calculations deduced from experiments for ascertaining the power employed in the propulsion of steam vessels, it is important to determine the loss in utilized effect, resulting from the friction of the engine. This loss has been variously stated by different authors, who have, however, so far as I am aware, given only approximate estimates, without calculating it from known data. Exact results cannot, it is true, be obtained, because the condition of the "journals" or rubbing surfaces varies so constantly, whether from improper keying up, or imperfect lubrication, that the same engine would give very different coefficients at different times. It would, however, be interesting to inquire what is the friction incident to a normal state of affairs, and upon that basis, make allowances according to the circumstances of any special case.

The losses consequent upon friction may be stated as follows: 1st, the friction on the rubbing surfaces depending on the weight; 2d, the friction and resistance of the air to the moving parts; these, with the force required to work the air and feed pumps, and the valves, with the friction of these forces, make up a sum, which expresses what is called the "power to work the engine without load." If to this we add, 3d, the friction of the load put upon the engine, we shall have expressed all the deductions to be made from the gross power developed by a marine engine, in order to find that transmitted to the wheels or propeller.

Of these causes of loss, the (2d) resistance of the air to the moving parts, is too trifling to enter into a calculation of practical value. That of the air pump varies, of course, with the head against which the waste water is discharged, with the vacuum attained, etc.; but as an average for marine side lever engines, upon which form the present calculation is based, (when steam is expanded two to three times,) it has been found by indicator diagrams, to vary from 6 to 7 pounds per square inch of area of the air pump. When the latter has a capacity of ⅕th the cylinder, the resistance in pounds per square inch of cylinder piston would be $r=\frac{(6+7)\times\cdot20}{2\times2}=0\cdot65$; since the air pump piston makes but one working stroke, while that of the cylinder performs two. If the ratio of capacities be ·22, then $r=\frac{6\cdot5\times\cdot22}{2}=0\cdot715$, and if ·24, then $r=\frac{6\cdot5\times\cdot24}{2}=0\cdot78$; if only ·18, $r=\frac{6\cdot5\times\cdot18}{2}=\cdot585$. Hence it may be stated in general terms, that the mean resistance caused by the air pump, is $\frac{7}{10}$th pound per square inch of the steam piston.

The friction of journals was found by Morin, (*Lecons de Mécanique Pratique*, 1re *Partie*,) to be unaffected by the velocity and extent of surface, and dependent simply on the pressure. The coefficient is stated to be ·05 the pressure when lubrication is constantly applied, and ·075 when it is renewed from time. As the latter is generally the case, we shall employ that coefficient.

The power required in a given time, to overcome the friction of any journal, will therefore be the product of this coefficient, by the mean pressure exerted upon it, and by the distance passed over by a point in the circumference of the journal during that time. Hence, the greater the diameter of a journal, other things being equal, the greater will be the friction, because with the same angular motion, a point in the circumference passes over a greater distance.

In calculating the friction without load, I shall take for an example a side lever engine of 72 inch cylinder, 8 feet stroke, of which I have the weights; a similar process may be applied to any other description of engine with equally correct results.

In this instance, if D represents the diameter of the cylinder, that of the main shaft journals is 0·2 D; outboard journals, 0·14 D; crank pins, 0·125 D; end beam pins, 0·084 D; air pump beam pins, 0·06 D; side lever centres 0·167 D; the angular motion of the side lever during a double stroke is 0·28 × circumference; hence the distances passed over during that time will be respectively—end beam pins, ·28 × 3·1416 × ·084 D=0·074 D; main journals, 3·1416 × ·2D=0·63 D; outboard journal, S=0·44 D; crank pin=0·39 D; side lever centre,=0·145 D; air pump beam pins=0·053 D.

The weights in round numbers are, on the outboard journals, 62,000 lbs., main journals, 31,000; crank pin, 4000; cross tail pins, 12,000; side rod pins, 16,000; air pump pins, 6000, and on the side lever centres, 56,000. The friction of weight will therefore be, (remembering that D=6 feet,)

Main journals,	·075	× 31,000	× ·63	D=	8790 lbs.	lbs.
Outboard journals,	"	× 62,000	× ·44	" =	12276 "	21,066 "
Crank pin, weight,	"	× 4,000	× ·39	" =	702 "	
" " previous friction	"	× 21,066 ÷ 16	× ·39	" =	232 "	934 "
Cross tail pins, weight,	"	× 12,000	× ·074	" =	400 "	
" " previous friction,	"	× 2,000 ÷ 16	× ·074	" =	46 "	446 "
Air pump pins, weight,	"	× 6,000	× ·053	" =	138 "	138 "
Side rod " "	"	× 16,000	× .074	" =	533 "	
" " previous friction,	"	× 2,446 ÷ 16	× ·074	" =	47 "	580 "
Side lever centres, weight,	"	× 56,000	× ·145	" =	3660 "	
" previous friction	"	× 44,992 ÷ 16	× ·145	" =	184 "	3,844 "
Whole friction for a double stroke,						27,008

Therefore, the power required to be developed by the engines=area of cylinder × twice stroke × x,=27008, and x=pressure in pounds per square inch of piston$=\frac{27,008}{4071 \times 16}=0·36$, or allowing for imperfect lubrication, say ½-pound.

To this must be added, the friction of packing in the cylinder and pumps; an element very difficult to fix upon, as it depends entirely on the description and condition of the packing employed. In the absence of direct experiment, observation induces me to believe that this friction in well kept packing, does not exceed from ½ to 1 pound per square inch of rubbing surface, which on a 72 inch cylinder with rings 5 inches deep, would amount to, from 615 to 1230; in that case, the area of piston, being 4071, the pressure required would be $\frac{615}{4071}$ to $\frac{1230}{4071}$=0·15 to 0·30 lbs. For the air pump, the same assumption would give per square inch of its area,

0·22 to 0·43, which by ·21 (ratio of capacities,)=0·046 to 0·092 lbs. on the steam piston. Finally, the friction of the power required to work the air pump is almost inappreciable, (about $\frac{1}{40}$th of a pound per square inch,) and may be neglected without serious error.

Summing up these elements we have,

1. Power to work the air pump,		0·585 to	0·780
2. Friction of weight,		0·500 "	0·500
3. " cylinder packing,		0·150 "	0·300
4. " air pump packing,		0·046 "	0·092
5. Power to work balance valves, Friction of Parallel motion, Resistance of the air, &c.	say	0·169 "	0·178
To work the engine without load,		1·450 "	1·850

Mean $\frac{1·450+1·050}{2}$=1·65 pounds per square inch. If the journals were kept constantly lubricated, as is the case when automaton lubricators are employed, the friction of weight would be only $\frac{·50\times·05}{·075}$=·33, and the pressure would be reduced to 1·65—·17=1·48 pounds per square inch. It therefore appears to me that 1·75 and 1·50 pounds would be a just allowance in these two cases respectively.

There now remains to be considered, the value of the friction of any load which may be put upon an engine of this description. It would be a tedious operation to obtain this with perfect accuracy, because, beginning at the cylinder with a given pressure, the friction of the several parts would gradually diminish it, until, arriving at the shaft journals, it would be less by the whole friction of the engine. But it may be found with sufficient exactness for our present purposes, as follows:

Calling P=the mean pressure on the piston, over and above that required to work the engine without load, and A=the area of the cylinder in inches, then, as D=6 feet,

Friction on side rod pins	= ·075 AP×0·74	D=	·0333AP
" crosstail pins	= AP×0·74	"	·0333 "
" side lever centres	= 2 AP×0·145	"	·1305 "
" crank pin	= $\frac{2}{3·14}$ AP×0·39	"	·1118 "
" main journals	= $\frac{2}{3·14}$ AP×0·63	"	·1813 "
Total friction during a double stroke,			4902 "

But as the whole power developed in this time is AP×2S (S=8)=16AP, therefore, $\frac{·4902}{16}$=0·0307, the proportion of the whole power employed in overcoming friction of load, or if automaton lubricators be used, ·0307×$\frac{·05}{·075}$=0·0205, or two per cent. When it is recollected that this calculation is based upon perfect keying up, and proper lubrication, points which are generally not so well looked to as they should be, it does not appear that 4 and 5 per cent., respectively, are far from the true value of friction in ordinary cases.

The friction of any other form of engine might be calculated in the same manner, and I think a comparison would show that the side lever engine is not *quite* so much behind some others in this point of view, as has been *commonly* supposed.

*Steam Marine of the United States.**

At the last session of Congress, the Senate, by resolution, directed the Secretary of the Treasury to collect and report statistics, exhibiting officially the External and Internal Steam Marine of the United States. William D. Gallagher, Esq., was commissioned to obtain the Inland, and Professor E. D. Mansfield the External; and most faithfully and ably have they discharged the arduous duty. The aggregate results far exceed, in magnitude and importance, the most extravagant estimates and anticipations. These reliable facts and statistics were reported to the Senate on Thursday last, by the Secretary of the Treasury. We take the subjoined statements from that Report:

The Steam Marine of the United States, on the Atlantic and Pacific Coasts and the Gulf of Mexico, is as follows:

From Passamaquoddy Bay to Cape Sable, there are 46 ocean steamers; 274 ordinary steamers; 65 propellers, and 80 ferry boats. Tonnage, 154,270 tons. High pressure steamers, 116; low pressure, 342. Number of officers and crews, 8,348. Passengers annually, 33,114,782. Average miles traveled, 8,118,989. These statistics refer to the year ending July 1, 1851.

The steam marine on the Gulf of Mexico, from Cape Sable to the Rio Grande, consists of 12 ocean steamers; 95 ordinary steamers; 2 propellers. Tonnage, 23,244. High pressure, 97; low pressure, 10. Number of officers and crews, 3,473. Passengers during the year, 148,700. Number of miles traveled, 1,360,380.

The steam marine on the Pacific Coast consists of 37 ocean steamers; 13 ordinary steamers. Tonnage, 34,986. High pressure, 3; low pressure, 47. Officers and crews, 1949. Average miles traveled, 79,209.

The aggregates of the external steam marine are:

Ocean steamers, 96; ordinary steamers, 382; propellers, 67; ferry boats, 80. Total, 625. Total tonnage, 212,500. High pressure, 213; low pressure, 412. Officers and crews, 11,770. Annual passengers, 33,342,846. Of the annual passengers, 24,009,550 were by ferry boats.

The Shipwrecks in the United States, on the Atlantic and Pacific Coasts and Gulf of Mexico, during the year ending July 1, 1851, were 50 ships, 59 brigs, 190 schooners, 9 sloops, and 20 steamers. Total, 328; of which 278 were by tempest, 14 by fire, 15 by collision, 19 by snags, and 2 by explosion. The number of lives lost was 318.

The "human movement," by steamboat, on the principal tide water lines was as follows:

	No. of Pass'rs.
On Long Island Sound,	302,397
On Hudson River,	995,100
Between New York and Philadelphia by Steamers,	840,000
On Potomac and James Rivers and Chesapeake Bay,	422,100
Gulf of Mexico,	169,508
Pacific Coast,	79,209

In 26 Districts on the Atlantic Coast, there were 160 vessels lost, valued at $1,559,171, and on which insurance was paid to the amount of $968,350.

* From the New York Tribune, January 26, 1852.

In New York, the marine insurance paid was	$ 3,520,161
In Philadelphia, ...	906,616
In Boston, ...	554,865

The total marine (not inland) insurance paid during the year is estimated at $6,227,000.

The Inland Steam Marine of the United States comprises three grand divisions—the Northern Frontier, the Ohio Basin, and the Mississippi Valley:

	Steamers.	Tonnage.	Officers & Crew.	Passengers.
The Northern Frontier has	164	69,165	2,855	1,513,390
The Ohio Basin, . .	348	67,601	8,338	3,464,967
The Mississippi Valley,	255	67,957	6,414	882,593
Total, . .	765	204,723	17,607	5,860,950

Of the passengers, 2,481,916 were by ferry boats, and in addition to the above, there were 1,325,911 passengers by railroads, 86,000 by canals, and 27,872 by stages, on the Northern Frontier line of travel, and 265,936 railroad and 28,773 stage passengers on the Ohio Basin line.

Travel to and from Inland Commercial Centres.

Pittsburgh (last year), ...	466,856
St. Louis, ...	367,795
Buffalo, ...	622,423
Chicago, ...	199,883
Total, ...	1,656,957

The resident population of these four cities is but 217,966.

The travel to and from Buffalo "comes and goes" as follows:

By ordinary steamers, ...	157,257
Propellers, ...	14,300
Ferry Boats, ...	26,280
Buffalo and Rochester Railroad, ...	262,386
Niagara Railroad, ...	119,200
Erie Canal, ...	43,000
Total, ...	622,423

St. Louis has 131 steamers; New Orleans, 109; Detroit, 47; Buffalo, 42; Pittsburgh, 12. During eight years, ending July 1, 1851, the tonnage in the Buffalo District has increased 19,217 tons; in Presque Isle, 2778; Cuyahoga, 4563; and in Detroit, 14,416. The steamboat tonnage of the Upper Lakes has more than quadrupled in eight years, and on the Mississippi Valley it has doubled in nine years.

The steamboat disasters on the Mississippi and tributaries since the introduction of steam to the year 1848, are, by collision, 45; fire, 104; snags, 469—total, 618. The original cost of the boats, $9,899,748; deficiency in value, $5,176,757; final losses, $4,719,991. The loss in 1849 is stated at $2,000,000.

Losses on the lakes and rivers during the year ending July 1, 1851, by tempest, 35; fire, 30; collision, 18; snags, 32. Persons lost on the lakes, 87, and on the rivers, 628—total, 695.

The average tonnage of Lake steamers is 437 tons; of the Ohio Basin, 206; and of the Mississippi Valley, 273.

Of the 558 ordinary steamers on the rivers, 317 are enrolled in the Districts of the Ohio Basin, and 241 in those of the Mississippi Valley.

Of the 147 ordinary steamers and propellers on the Lakes, 31 are enrolled on the Lakes Champlain and Ontario and the St. Lawrence, 66 on Lake Erie, and 60 at Detroit and the Lakes above.

Of the 164 steam vessels on the Lakes, 105 are ordinary steamers, 52 are propellers, and 43 are ferry boats.

Of the 601 steam vessels on the rivers, 558 are ordinary, and 43 are ferry boats.

With but two very slight exceptions, there is an uninterrupted line of steam navigation from the waters of the Gulf of St. Lawrence to those of the Gulf of Mexico—a distance of about 28,000 miles, and upon which is employed, for the purposes of trade and travel, a steam tonnage of 50,166 tons. The Ohio Basin forms, of itself, a cross section of about 1100 miles in length.

The steam marine of Great Britain and her dependencies is stated to consist of 1184 boats, with 142,080 tonnage; while the inland steam marine of the United States consists of 766 boats, with a tonnage of 204,613 tons—showing that, exclusive of the steam tonnage of the Atlantic and Pacific seaboard and the Gulf coast, the inland steam tonnage exceeds that of Great Britain and her dependencies by 62,533 tons.

On the Production of Instantaneous Photographic Images. By H. F. Talbot.*

It will probably be in the recollection of some of your readers that in the month of June last a successful experiment was tried at the Royal Institution, in which the photographic image was obtained of a printed paper fastened upon a wheel, the wheel being made to revolve as rapidly as possible during the operation.

From this experiment the conclusion is inevitable, that it is in our power to obtain the pictures of all moving objects, no matter in how rapid motion they may be, provided we have the means of *sufficiently* illuminating them with a sudden electric flash. But here we stand in need of the kind assistance of scientific men who may be acquainted with methods of producing electric discharges more powerful than those in ordinary use. What is required is, vividly to light up a whole apartment with the discharge of a battery:—the photographic art will then do the rest, and depict whatever may be moving across the field of view.

I had intended to communicate much earlier the details of this experiment at the Royal Institution, but was prevented from doing so at the time,—and soon afterwards I went on the Continent in order to observe the total solar eclipse of the 28th of July. This most interesting phenomenon I had the pleasure of witnessing at the little town of Marienburg, in the north-eastern corner of Prussia. The observations will appear, I believe, in a forthcoming volume of the Transactions of the Royal Astronomical Society. Among other things, I was enabled to make a satisfactory estimate of the degree of darkness during the total obscuration, which proved to be equal to that which existed one hour after sunset the same evening, the weather being during that evening peculiarly serene, so as to allow of a just comparison.

* From the London Athenæum, December, 1851.

This Continental journey having effectually interrupted my photographic labors, I have only recently been able to resume them. I shall, therefore, now proceed to describe to you exactly the mode in which the plates were prepared which we used at the Royal Institution: at the same time not doubting that much greater sensibility will be attained by the efforts of the many ingenious persons who are now cultivating the art of photography. And it is evident that an increased sensibility would be as useful as an augmentation in the intensity of the electric discharge.

The mode of preparing the plates were as follows:—

1. Take the most liquid portion of the white of an egg, rejecting the rest. Mix it with an equal quantity of water. Spread it very evenly upon a plate of glass, and dry it at the fire. A strong heat may be used without injuring the plate. The film of dried albumen ought to be uniform and nearly invisible.

2. To an aqueous solution of nitrate of silver add a considerable quantity of alcohol, so that an ounce of the mixture may contain three grains of the nitrate. I have tried various proportions, from one to six grains, but perhaps three grains answer best. More experiments are here required, since the results are much influenced by this part of the process.

3. Dip the plate into this solution, and then let it dry spontaneously. Faint prismatic colors will then be seen upon the plate. It is important to remark, that the nitrate of silver appears to form a true chemical combination with the albumen, rendering it much harder, and insoluble in liquids which dissolved it previously.

4. Wash with distilled water to remove any superfluous portions of the nitrate of silver. Then give the plate a second coating of albumen similar to the first; but in drying it avoid heating it too much, which would cause a commencement of decomposition of the silver. I have endeavored to dispense with this operation, No. 4, as it is not so easy to give a perfectly uniform coating of albumen as in No. 1. But the inferiority of the results obtained without it, induces me for the present, to consider it as necessary.

5. To an aqueous solution of prot-iodide of iron add *first*, an equal volume of acetic acid, and then ten volumes of alcohol. Allow the mixture to remain two or three days. At the end of that time it will have changed color, and the odor of acetic acid as well as that of alcohol will have disappeared, and the liquid will have acquired a peculiar or agreeable vinous odor. It is in this state that I prefer to employ it.

6. Into the iodide thus prepared and modified the plate is dipped for a few seconds. All these operations may be performed by moderate daylight, avoiding, however, the direct solar rays.

7. A solution is made of nitrate of silver, containing about 70 grains to one ounce of water. To three parts of this add two of acetic acid. Then if the prepared plate is rapidly dipped once or twice into this solution it acquires a very great degree of sensibility, and it ought then to be placed in the camera without much delay.

8. The plate is withdrawn from the camera, and in order to bring out the image it is dipped into a solution of protosulphate of iron, containing one part of the saturated solution diluted with two or three parts of water. The image appears very rapidly.

9. Having washed the plate with water it is now placed in a solution

of hyposulphite of soda, which in about a minute causes the image to brighten up exceedingly, by removing a kind of veil which previously covered it.

10. The plate is then washed with distilled water, and the process is terminated. In order, however, to guard against future accidents, it is well to give the picture another coating of albumen or of varnish.

These operations may appear long in the description, but they are rapidly enough executed after a little practice.

In the process which I have now described, I trust that I have effected a harmonious combination of several previously ascertained and valuable facts,—especially of the photographic property of iodide of iron, which was discovered by Dr. Woods, of Parsonstown, in Ireland, and that of sulphate of iron, for which science is indebted to the researches of Mr. Robert Hunt. In the true adjustment of the proportions, and in the mode of operation, lies the difficulty of these investigations, since it is possible by adopting other proportions and manipulations not very greatly differing from the above, and which a careless reader might consider to be the same, not only to fail in obtaining the highly exalted sensibility which is desirable in this process, but actually to obtain scarcely any photographic result at all.

To return, however, from this digression. The pictures obtained by the above described process are negative by transmitted light and positive by reflected light. When I first remarked this, I thought it would be desirable to give these pictures a distinctive name, and I proposed that of *Amphitype*, as expressive of their double nature, at once positive and negative. Since the time when I first observed them, the Collodion process has become known, which produces pictures having almost the same peculiarity. In a scientific classification of photographic methods, these ought, therefore, to be ranked together as species of the same genus. These Amphitype pictures differ from the nearly related Collodion ones in an importance, viz., the great hardness of the film and the firm fixation of the image, which is such that in the last washing, No. 10, the image may be rubbed strongly with cotton and water without any injury to it; but, on the contrary, with much improvement, as this removes any particles of dust or other impurity, and gives the whole picture a fresh degree of vivacity and lustre. A daguerreotype picture would be destroyed by such rough usage before it was completely fixed and finished.

In examining one of the amphitype pictures, the first thing that strikes the observer is, the much greater visibility of the positive image than of the negative one; since it is not rare to obtain plates which are almost invisible by transmitted light, and which yet present a brilliant picture full of details when seen by reflected light.

The object of giving to the plates a second coating of albumen, as prescribed in No. 4, is chiefly in order to obtain this well developed positive image; for it is a most extraordinary fact, that a small change in the relative proportions of the chemical substances employed enables us at pleasure to cause the final image to be either entirely negative or almost entirely positive. In performing the experiment of the rotating wheel the latter process must be adopted; since the transmitted or negative image is not strong enough to be visible unless the electric flash producing it be an exceedingly bright one.

I now proceed to mention a peculiarity of those images which appear to me to justify still further the name of Amphitype, or, as it may be rendered in other words ambiguous image. Until lately I had imagined that the division of photographic images into *positive* and *negative* was a complete and rigorous one, and that all the images must be of either the one or the other kind. But a third kind of image of a new and unexpected nature is observed upon the Amphitype plates. In order to render this intelligible, I will first recall the general fact that the image seen by transmitted light is negative and that by reflected light positive. Yet, nevertheless, if we vary the inclination of the plate, holding it in various lights, we shall not fail speedily to discover a position in which the image is positive although seen by transmitted light. This is already a fact greatly requiring explanation. But the most singular part of the matter is, that in this new image (which I call the *transmitted positive*,) the brightest objects (viz: those that really are brightest, and which appear so in the *reflected positive*) are entirely wanting. In the places where these ought to have been seen, the picture appears pierced with holes, through which are seen the objects which are behind. Now, if this singularity occurred in all the positions in which the plate gives a positive image, I should be satisfied with the explanation that the too great brightness of the objects had destroyed the photographic effect which they had themselves at first produced. But since this effect takes place in the *transmitted positive* but not in the *reflected positive*, I am at a loss to suggest the reason of it, and can only say that this part of optical science, dependent upon the molecular constitution of bodies, is in great need of a most careful experimental investigation.

The delicate experiment of the revolving wheel requires for its success that the iodide of iron employed should be in a peculiar or definite chemical state. This substance presents variations and anomalies in its action which greatly influence the result. Those photographers, therefore, who may repeat the experiment will do well to fix their principal attention upon this point. It is also requisite in winter to warm the plates a little before placing them in the camera. In pursuing this investigation, I have been much struck with the wide field of research in experimental optics which it throws open. By treating plates with albumened glass with different chemical solutions, the most beautiful Newtonian colors, or "colors of thin plates," may be produced. And it often happens that the landscapes and pictures obtained by the camera present lively though irregular colors. These not being in conformity with nature are at present useless; with this exception, nevertheless, that in many pictures I have found the color of the sky to come out of a very natural azure blue. I hope soon to have the leisure requisite for pursuing this very interesting branch of inquiry, and in the mean time I venture to recommend it to the notice of your scientific readers.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, January 15, 1852.

S. V. Merrick, President, in the chair.

John F. Frazer, Treasurer.

J. Vaughan Merrick, Recording Secretary, P. T.

The minutes of the last meeting were read and approved.

A Letter was read from the Royal Geographical Society, London.

Donations were received from The Royal Astronomical Society, London; The Royal Irish Academy, Dublin; Ellwood Morris, Esq., Pittsburgh, Penn'a.; and Messrs. Charles E. Smith, Julius H. Rae, Percival Roberts, John C. Trautwine, William Firmstone, and A. W. Rae, Philadelphia.

A complete Geological suit of 700 Specimens, selected and arranged by the Mineralogical Institute of Heidelburg, Germany, accompanied by printed catalogues and printed labels in German, French, and English, was purchased and presented to the Institute by several of the members.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of December; also, his annual statement of the Funds of the Institute, and the annual statement of the transactions of the Journal of the Institute.

The Board of Managers and Standing Committees reported their minutes.

The Committee on the Library reported that they had so amended the regulations for the government of the Library, as to allow members to take from the Library, during the recess of the meetings of the Committee, books belonging to the "First Class," on obtaining the consent in writing of two members of the Committee.

On motion, the amendment was approved by the Institute.

The Committee on the School of Design for Women, and the Trustees of the Elliott Cresson Medal, not being prepared to report—Mr. F. Fraley made a verbal statement in relation thereto, and said that the regular reports in writing would be submitted at the next meeting of the Institute.

New candidates for membership in the Institute (15) were proposed, and the candidates (21) proposed at the last meeting were duly elected.

The Tellers of the annual election for Officers, Managers, and Auditors, for the ensuing year, reported the result, when the President declared the following gentlemen as duly elected:

Samuel V. Merrick, President.

Thomas Fletcher, }
Abraham Miller, } Vice Presidents.

Isaac B. Garrigues, Recording Secretary.

Solomon W. Roberts, Corresponding Secretary.

John F. Frazer, Treasurer.

MANAGERS.

M. W. Baldwin,	Owen Evans,	Eliashib Tracy,
Frederick Fraley,	Alan Wood,	Geo. P. Whitaker,
John Agnew,	Asa Whitney,	Jos. J. Barras,
John Wiegand,	Isaac S. Williams,	Geo. N. Eckert,
John C. Cresson,	H. P. M. Birkinbine,	Charles E. Smith,
John H. Towne,	Geo. W. Conarroe,	John C. Trautwine,
Edwin Greble,	Thos. J. Weygandt,	Wm. D. Parrish,
David S. Brown,	Peleg B. Savery,	Frederick Graff.

AUDITORS.

Algernon S. Roberts, Samuel Mason,
Uriah Hunt.

Dr. Rand exhibited to the meeting, through the kindness of Mr. Cornelius, a form of Argand Burner, having an annular jet, the inconveniences of which form of jet were obviated by the peculiar arrangement of concentric cones composing it, and the manner in which the supply of air is admitted and regulated. The photometric results of this burner will be communicated at a future meeting, in the report of which a more detailed account of its construction will be made.

Mr. Bartol gave an account of the operation of the combined Vapor Engine, which he had seen in a recent visit to New York.

Mr. G. W. Smith explained the method adopted at the establishnent of Reeves, Buck & Co., Phœnixville, Penn'a, for the manufacture of old and worn Railroad Bars, which he illustrated by drawings. He described the mode of piling, and the introduction of new iron. The form of the new pieces thus introduced could not be understood without engravings. A reference to the work of Valerius on the fabrication of Iron, exhibits a method somewhat analogous. Mr. S. stated that this establishment at Phœnixville was the only one, known to him, in the United States, where this very advantageous process had been introduced. In England and elsewhere, the usual method is to reduce the T rails, when worn, into the shape of flat bars, previous to piling and remanufacturing.

Prof. Cresson made a few remarks on the manufacture of Railway Bars, showing in what manner the hard and soft parts of the metal should be disposed to form the most perfect rail.

Prof. Cresson was requested to give some account of the late attempts to adapt locomotive engines to the use of anthracite as fuel. He stated that numerous contrivances for this purpose are now in course of trial on several of the railroads engaged in the transportation of this fuel to market, principally on the road from Philadelphia to Reading and Pottsville.

The chief difficulty in using anthracite in locomotives arises from the intensity of the local heat, when the combustion is at its height, by which the metal in contact with the fuel is rapidly destroyed. From the peculiar nature of the fuel, the tendency of the blast produced by the exhaust is to create a sort of unstable equilibrium in the action of the fire, or a tendency to excess on either side of the proper mean; thus the hotter the fire the higher the steam, and as this increases, the blast becomes sharper and the fire still more vehemently urged. Among the expedients heretofore tried for curing the evil, the most effectual have been the use of a blower instead of the exhaust blast, and a peculiar form of nozzle to the exhaust pipe, by which the force of the blast can be varied at will by the engineer. These have alleviated the difficulty, but not entirely cured it. The most recent scheme is that carried into practice by Mr. Mulhollend, the manager of the machine shops of the Philadelphia and Reading Railroad, which closely resembles one for which a caveat was filed in the Patent Office several years ago by Mr. M. W. Baldwin. It consists of two principal parts, one for shielding the fire-box by a stratum of coal in a state of imperfect combustion and consequent moderate heat, and the other for detaining and burning the gaseous carbonic oxide produced by the imperfect combustion of the coal. The first effect is obtained by having a broad plate or flanch of cast iron, placed around the fire grate

n contact with the walls of the fire-box. The part of the coal that rests n this shelf receives an insufficient supply of air for active combustion, nd shields the iron of the boiler from the more active fire resting on the rate.

To provide for the detention and combustion of the carbonic oxide gas, ie flues are made in two separate lengths, with a box or gas chamber nterposed; the set of flues attached to the fire box being quite short nd of larger calibre than usual, and those in the front end of the boiler f the usual diameter and nearly the usual length. Fresh air is admitted nto the gas chamber from the ash pan, and the inflamed gas drawn rough the forward flues by the blast of the exhaust. The only trouble xperienced thus far in using these engines, is said to arise from the diffiulty of keeping the short flues of large calibre perfectly steam tight, but it s believed that this will be removed by slightly diminishing their diameter, nd that with this change, the results will be entirely satisfactory.

Mr. G. W. Smith, in compliance with his promise at the last meeting, gave ome additional returns from the anthracite coal regions of Pennsylvania, which, added to those formerly given, presented a grand total of 5,100,000 ons mined in the State of Pennsylvania, during the last year, making an ggregate of bituminous and anthracite, of 7,500,000 tons nearly.

Mr. Smith requested the attention of the meeting to the necessity of egislative enactments for the protection of buildings from fire; described ie many disastrous conflagrations in Philadelphia, and other cities of the nion, with a comparative exemption of the cities of London and Paris; riefly described the mode of building prescribed by law in those cities, nd the beneficial results therefrom; recommended the subject to the conderation of the Institute, by submitting the following resolution:

Resolved, That a committee be appointed to memorialize the Councils of the City of hiladelphia, to pass an ordinance to render buildings more secure against fire.

Mr. Fraley stated that by an Act of Assembly passed in the year 1832, ll power had been given to the Corporation of the City of Philadelphia, o prohibit within the limits of said City, the erection of buildings of wood r other combustible materials. That it had also been empowered by ie same act to fix and determine the height, thickness, and materials of ne walls, and the general character of buildings thereafter to be erected n said city, with the special view of guarding, as far as might be posible, against the ravages and injuries of fire. He was not aware that ny like power had been granted to the municipal corporations of the County of Philadelphia, and that therefore, the provision of the law, as it now stands, was only limited in its effect, and so far as he knew, had not yet been enforced in the city, further than to prohibit the erection of wooden and brick-paned buildings of a certain description. He hoped a strong expression of public opinion would now be made, calling upon the councils to execute the powers given to them by the act of 1832, and also upon the Legislature to extend them if necessary, and to make the law operative over the whole county.

On motion, the resolution was adopted, and the following gentlemen were appointed the

Committee.—Messrs. G. W. Smith, John C. Cresson, George Erety, John M'Clure, and Wm. T. Forsyth.

Alderman Geo. Erety remarked on the evils resulting from crowding small houses together in courts and blind alleys, at the expense of light, cleanliness, and ventilation, and offered the following resolution:

Resolved, That a Committee be appointed to ask from the Legislature, the passage of laws to secure such space and ventilation as will promote health, in houses built for dwellings, in the City and County of Philadelphia.

The subject was discussed by Messrs. Erety, Smith, Prof. Cresson, Dr. Turnbull, and Dr. Rand, when, on motion, the resolution was adopted, and the following gentlemen were appointed the

Committee.—Messrs. Geo. Erety, Dr. L. Turnbull, Dr. Isaac Parrish, John F. Frazer, and Dr. B. H. Rand.

Erratum.

In transcribing the results of experiments made with the burners proposed by Dr. Goddard, for microscopic observations, of which a statement was presented at the December monthly meeting of the Institute, the numbers representing the relative economy of light given by the burners were erroneously stated representing the standard candles to which the burners were severally equivalent. To correct this error, the subjoined table of consumption and equivalent candles is furnished by the committee which made the experiments:

Kind of Burner.	Consumption per hour.	Equivalent No. of candles.	Economy of Light.
Fishtail, .	5·7 cubic feet.	29·1	13·53 or 1·487
Goddard's, .	2·65 "	9·1	9·1 or 1·000
Second form of do.	2·75 "	10·4	9·92 or 1·090

The unequalled steadiness and uniformity of the two latter burners render them of great value for readers and microscopists.

BIBLIOGRAPHICAL NOTICE.

Bartol's Marine Boilers of the United States.

This little book is a collection of drawings of the boilers of the principal steamers, (64 in number,) constructed in this country; each drawing accompanied by a statement of the dimensions and draft of the vessel, the description and size of the engines, and of the side wheel or propeller; the average number of revolutions, pressure of steam, and point of expansion; the consumption of fuel, and a description of the boilers, with their heating and grate surfaces, relative areas of flues, chimney, &c.; the whole summed up by a calculation of the amount of water evaporated per pound of coal, and the consumption of coal per square foot of grate. Means are thus afforded for an accurate comparison of the different forms of boilers employed, the drawings and data being in all cases authentic.

As a concise statement of what has been done in America for the advancement of steam navigation, this book may be recommended to engineers. No pretensions are made to the establishment of theories. The author, strictly confining himself to facts, leaves his readers to draw their own inferences. M.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

MARCH, 1852.

CIVIL ENGINEERING.

---

*On the Preservation of Timber by Creosote.**

Wood may be briefly stated to be composed of a fibrous tissue, which, upon examination with the microscope, is found to consist of longitudinal tubes, arranged in concentric rings around the centre pith;—these tubes varying in diameter from $\frac{1}{2000}$th to $\frac{1}{200}$th part of an inch. The use of these tubes in a growing tree is to convey the sap from the root to the branches; and after the tree is cut up for use, they contain the chief constituent of the sap, vegetable albumen, a substance very much resembling in its composition animal albumen, or the white of an egg. Different woods vary in the proportion which they contain of this substance; but in the softer woods it averages one per cent.

The dry rot in timber is caused by the putrefaction of the vegetable albumen, to which change there is a great tendency; and when once this has taken place, it soon infects the woody fibre, inducing decomposition, and causing its entire destruction. Many plans have been employed to arrest this evil, each with more or less success,—the chief aim of the authors being to coagulate the albumen by means of metallic salts, and so prevent putrefaction. Among others may be mentioned the following, as being the most successful:—Kyan's process, by the use of chloride of mercury; Burnett's, by chloride of zinc; and Payne's, by sulphate of iron and muriate of lime, forming an insoluble precipitate in the pores of the wood. To each of these plans there are serious objections in practice. In the first place, when metallic salts are injected into timber in sufficient quantities to crystallize, the crystals force open the pores, causing a disruption of the fibre; and when the timber afterwards becomes wet, they dissolve, leaving large spaces for the lodgment of water, and rendering timber much weaker. Secondly, the metallic salts being incapable of

* From the London Journal of Arts and Sciences, December, 1851.

sealing the pores of the wood, the fibre is still exposed to the action called eremacausis—a process of oxidation—after the albumen has been precipitated. These processes are also objectionable for wood that requires iron to be inserted in or attached to it, as the acids act upon the iron in a manner well known, and ultimately destroy it.

The plan that is the subject of the present paper is the one invented by Mr. Bethell, for the use of a material obtained by the distillation of coal tar. This material consists of a series of bituminous oils, combined with a portion of creosote: which latter substance is acknowledged to possess the most powerful antiseptic properties. The action of the material may be thus described: When injected into a piece of wood, the creosote coagulates the albumen, thus preventing the putrefactive decomposition; and the bituminous oils enter the whole of the capillary tubes, encasing the woody fibre as with a shield, and closing up the whole of the pores, so as entirely to exclude both water and air. The bituminous oils being insoluble in water, and unaffected by air, the process is thereby rendered applicable to any situation. So little is bituminous oil affected by atmospheric change, that the writer has seen wrought iron pipes that had merely been painted over with it, and laid in a light ground, one foot beneath the surface, taken up after twenty years, and they appeared and smelt then as fresh as when first laid down.

By using these bituminous oils, the most inferior timber, and that which would otherwise soonest decay, (from being more porous, and containing more sap, or being cut too young, or at the wrong season,) is rendered the most durable. This will be readily understood when it is considered that this porous wood will absorb a larger portion of the preserving material than the more close and hard woods: in fact, the soft woods are rendered hard by this process. By this means, therefore, engineers will be enabled to use a cheaper timber with greater advantage than they could use a more expensive timber uncreosoted; thus, taking the cost of a sleeper of American yellow pine at 4*s*., and one of Scotch fir at 3*s*., and then adding 1*s*. to the latter for creosoting, the two would be the same cost; but the former one would last, under the most favorable circumstances, not more than ten or twelve years; and the other would be good, under any circumstances, in all probability in a hundred years.

This system of preserving timber has been in use on several railways, and other works, for several years past. A portion of the London and North Western Railway, about seventeen miles in length, has been laid with the creosoted sleepers from nine to eleven years; during which period the engineer reports that no instance has occurred in which any decay has been detected in them, and they continue quite as sound as when first put down. On the Stockton and Darlington Railway, creosoted sleepers have also been laid for ten years, and are found to continue without any appearance of change or decay; also, on the Lancashire and Yorkshire Railway creosoted timber has been used for five years, as paving blocks, posts, &c.; the upper part has become very hard, and the part under ground appears as fresh as when taken out of the creosote tank, though the timber was of inferior, sappy quality. In a trial, commenced twelve years since, by Mr. Price, of Gloucester, of the comparative durability of timber in the covers of a melon pit, where it was exposed con-

stantly to the combined action of decomposing matter and the atmosphere, the unprepared timber became decayed in one year, and required replacing in a few years; a portion of the timber that had been Kyanized lasted well for about seven years, but then very slowly decayed; while the timber that had been creosoted still continues as sound as when first put down.

Not only does this creosoting process render wood free from decay, but it also preserves it from the attacks of the teredo worm, when used for ship building, harbors, docks, and other work contiguous to the sea. This has been satisfactorily proved at Lowestoft harbor, where the plan has had a very extensive trial for four years; and the superintendent reports that the uncreosoted piles have all been attacked by the limnoria and the teredo to a very great extent, and in some instances are eaten through; but there is no instance whatever of a creosoted pile being touched, either by the teredo or the limnoria; and all the creosoted piles are quite sound, though covered with vegetation, which generally attracts the teredo. This is to be accounted for by the creosote remaining intact in the timber, either wet or dry; and, being destructive to all animal life, it is proof against the attack of these parasites; whereas, with the other processes, the metallic salts are washed out, or that portion which unites with and coagulates the albumen is rendered quite innocuous by the process.

There are two processes in use by Mr. Bethell, for impregnating timber with creosote. One is by placing the wood in a strong iron cylinder, and exhausting the air from it, by an air pump, until a vacuum is created, equal to about twelve pounds on the square inch; the creosote is then allowed to flow into the cylinder, and afterwards a pressure is put upon the creosote, by a force pump, equal to about 150 pounds on the square inch; and the timber, on being taken out, is fit for use.

The second process consists in first placing the timber in a drying house, and passing the products of combustion through it; thereby not only drying the timber rapidly, but impregnating it, to a certain extent, with the volatile oily matter and creosote contained in the products given off from the fuel used to heat the house. When the timber is taken out of this house, it is at once immersed in hot creosote in an open tank, thus avoiding the use of a steam engine, or pumps.

Mr. Clift exhibited specimens of creosoted sleepers, which had been in use for ten years on the London and North Western Railway, near Manchester, and were still perfectly sound and unchanged; also specimens of creosoted piles from Lowestoft Harbor, which had been in the sea for four years, and continued quite fresh and sound, and without being touched by the worm; and specimens of similar piles uncreosoted, from the same situation, which were completely eaten away and honeycombed by the worm in the same period.

Mr. Bethell observed, that when he first began to preserve timber, he found that no pressure would get the creosote into it, owing to the presence of moisture in the pores; it therefore became necessary to adopt the system of drying the timber first; and, after fourteen days, he found that the wood lost three pounds in weight in every cubic foot: this was by the old process of drying. He then introduced the present drying house;

and, in twelve or fourteen hours, they lost eight pounds per cubic foot, in Scotch sleepers, which then absorbed an equal weight of creosote. An average of 11½ lbs. of creosote per cubic foot was now put into all the Memel timber at Leith harbor works; and it was forced in with a pressure of 180 lbs. per inch. One piece of creosoted timber had been observed at Lowestoft, which had been half cut through for a mortise, but not filled up again, and a teredo had penetrated a little way into it at that part, and then attempted to turn to the right, and then to the left, and had ultimately quitted the timber without proceeding any farther. Young wood was the most porous round the exterior, and consequently absorbed most creosote, which formed a shield to keep off the worm. The creosoted sleepers were better, after eight or ten years, than when new, because the creosote got consolidated in them, and rendered them harder. He had taken the idea originally from the Egyptian mummy; it was exactly the same process; any animal put into a creosote tank assumed the appearance and became in like condition to a mummy. Timber creosoted was now chiefly used in railways; but he believed that, if it was introduced into coal pits, it would be found that no timber so used in those places would rot.

The Chairman inquired whether, in the process of creosoting, the quantity of sap was calculated, and how the exact quantity of creosote that was put into the timber was ascertained.

Mr. Bethell replied, that every piece of timber was weighed before it was put into the creosote tank, and again when taken out; and each piece was required to be increased in weight, by the process, 10 lbs. per cubic foot. The quantity of oil used always rather exceeded the weight gained in the timber, on account of the loss of weight from the moisture extracted by the exhaustion of the air pump. He also remarked, in answer to another question from the Chairman, that oak only absorbed half as much creosote as Memel timber. Common fir creosoted would last double the time of hard wood creosoted, because it took more creosote. Beech made the best wood, being full of very minute pores; and they could force a greater quantity of creosote into beech than into any other wood; consequently it took a more uniform color throughout from the process. Long pieces of timber were found to require more time to saturate them in proportion to their length. The creosote appeared to enter at the two ends, and be forced up through the whole length of the pores; and the progress was known by the quantity of creosote forced into the tank after it was filled, according to the number of cubic feet of timber contained in the tank.

An Investigation of the Strains upon the Diagonals of Lattice-beams, with the resulting Formulæ. By W. T. Doyne, *Assoc. Inst. C. E., and* Prof. W. B. Blood.*

The experiments detailed in the paper were made on a model 12 feet in length, so constructed that the diagonals in compression (which were strips of mahogany, let into the top and bottom, but not fastened to them, and the ties, which were of hoop iron chains,) must of necessity take their

* *From the* London Journal of Arts and Sciences, December, 1851.

respective bearing and strain; and by the substitution of a dynamometer for any one of the ties, the strain on it could be accurately measured.

The results of the investigation (which were given in a table, showing a remarkable coincidence between the strains as measured and calculated) were, that for a parallel beam of one span, supported at each end and loaded at the centre, the strains throughout the diagonals were uniform, and the horizontal strains were greatest at the centre, decreasing uniformly at the points of support. For a similar beam, uniformly loaded over its entire length, the strains on the diagonals commenced at the centre, increasing uniformly to the points of support; while the horizontal strains decreased from the centre to the ends, in the ratio of the ordinates of a parabola. These results were arrived at by different methods of reasoning, and the formulæ derived from them were stated to be applicable to the more complex form of a closely intersected lattice, taking into consideration the increased number of triangulations.—*Proc. Inst. Civ. Eng.*

On the Discharge of Water over Weirs and Overfalls. By THOMAS EVANS BLACKWELL, *M. Inst. C. E.**

[Paper read at the Institution of Civil Engineers, May 6, 1851.]

The establishment of certain natural laws in hydraulics has occupied the attention of philosophers from the days of Galileo to the present time, and although the great principles which now form the groundwork of modern hydraulic science are indisputably settled, yet much remains to be done by practical men, towards applying the necessary corrections for special circumstances; this is only to be accomplished by a faithful record of facts, and in engineering there is perhaps scarcely a branch where there is a greater want of them than in that of hydrodynamics.

This deficiency was particularly felt by the author of this paper, in the case of weirs or overfalls, established, by order of Parliament, for regulating and measuring the flow of water into a canal; and, as frequent doubts and disputes had arisen, the following experiments were undertaken for determining, by absolute trials, the discharge that might be expected from such orifices; and, as the opportunities for making such experiments are not of frequent occurrence, the results were carefully recorded, in order to submit them in detail for the consideration of the Institution.

The first set consists of a series of 243 experiments, made on overfalls of 3 feet, 6 feet, and 10 feet in width, with heads from 1 inch to 14 inches, and with the varying circumstances of having, for the overfall bar,—1st, a thin plate; 2d, a plank 2 inches thick; and, 3d, a crest 3 feet in breadth. These were all made on the Kennet and Avon Canal, in July, 1850.

The second set was made in conjunction with Mr. Simpson (V. P. Inst. C. E.), who has kindly permitted the results to be placed on record. The series consists of about 70 experiments, made on an overfall of about 10 feet in width. These were made at Chew Magna, Somerset, also in the summer of 1850. Although in some respects, as being made over a

* From the London Architect for January, 1852.

bar 2 inches thick and 10 feet long, many of the experiments are apparently parallel in both cases, they must be separately considered, on account of some peculiar circumstances which will be stated. Before considering these experiments in detail, it may be well to review, briefly, some of those previously ma deby English and Continental observers, and the practical deductions which had been arrived at by the writers on this subject.

Fig. 1. Plan.—Scale, 40 feet to 1 inch.

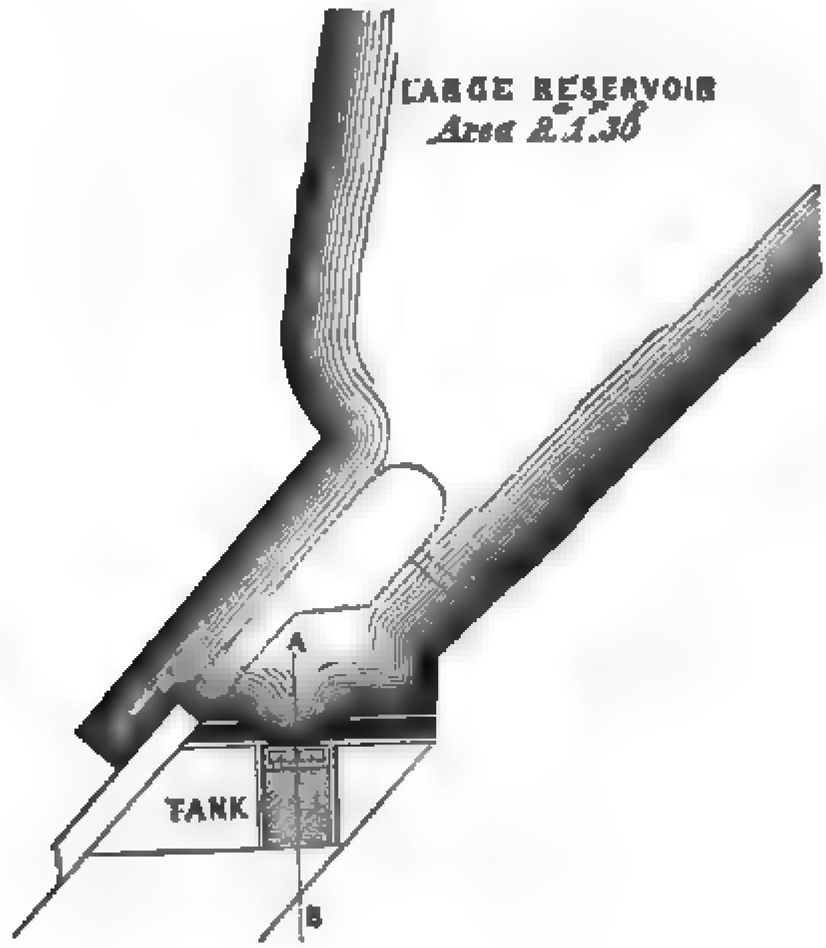


Fig. 2. Section on the line A B.—Scale, 8 feet to $\frac{3}{8}$ inch.

The most scientific series of experiments on the discharge of fluids through orifices have been made by foreign observers, and their labors must be familiar to hydraulic engineers; but the Chevalier Du Buat, Eytelwein, MM. D'Aubuisson and Castel, and MM. Poncelet and Lesbros, have made the principal observations on the passage of water over weirs.

Those of Du Buat, in 1779, were but few in number, and were on overfalls of 18¾ inches wide, and an extreme depth of 6¾ inches.

In 1827 and 1828, MM. Poncelet and Lesbros made a very elaborate series of experiments, on the discharge of water by rectangular orifices. They were conducted in the fortifications at Metz. Of these, only thirty-six related to overfalls, or 'deversoirs.' The head of water was varied from about ¾-inch up to 8 inches, and the width was constantly about 7¾ inches. They found that the coefficient for contraction was constantly varying, as the head was increased or diminished.

In 1834, MM. D'Aubuisson and Castel made a series of experiments, at the Toulouse water-works, with overfalls which discharged water from a rectangular canal 29¾ inches wide, and of variable depth. The widths of the apertures ranged upwards to the full width, and the head varied from about 1 inch to 8 inches.

Messrs. Smeaton and Brindley conducted a set of experiments, made over a waste-board of the width of 6 inches, and from 1 inch up to 6 inches deep. These, and the experiments of Dr. Robison, quoted in the *Encyclopædia Britannica*, appear to be the principal observations made and published in this country.

A comparison of the results of the foregoing experiments, and the coefficients applicable to them and to the present experiments, is given in the Appendix.

The Kennet and Avon Canal experiments were made on a reservoir, or side pond, measuring 2 acres, 1 rood, 30 poles, or 106,200 square feet in area, with a lock at each end, so that there was not any current. The weather was uniformly fine, and during six-sevenths of the time, the wind was very slight, blowing somewhat diagonally up stream, or against the course of the overfall; during one day the wind was more rough, blowing exactly down the stream; such of the experiments, made on that day, as are given in the tables, and are used in the calculations, are reduced to the standard of the others; a means of doing so being presented, by exactly parallel experiments, made on the more favorable days. It may not be uninteresting to know, that the coefficient of correction was found to be about 5 per cent.

The form of the overfall, and its relative size and position on the reservoir, will be understood by reference to figs. 1 and 2, and the object in presenting this memoir being to give an accurate record of facts, which may be of practical utility, it is necessary to point out two or three special circumstances, which may possibly, to some slight extent, have influenced the discharge, though the observations made during the progress of the experiments, would induce the belief that such influence was very small. The first is, that the water supplied from the reservoir above the one on which the experiments were made, did not feed exactly in the same proportion as it was taken out; it was let in by the upper lock, three or four times a day, or as often as was requisite. The area of the reservoir, however, was so large (106,200 square feet), that the difference of head between the beginning and the end of any one experiment, could scarcely be perceived. The second feature is, that at some little distance above the overfall, the depth of water was reduced, by a submerged course of masonry, belonging to the dock in which the trials were made,

and which rose to within 18 or 20 inches of the surface. The third f is, that the overfall was placed on the outer line of the dam, so obtain the requisite fall, and was not exactly in the line of one of the of the reservoir. These are circumstances which could not have bee veniently altered, without considerably increasing the expense of the riments, and as the approach to the overfall was at least 40 feet wi was thought that the general arrangements would fairly represent th of discharge of water by an overfall from a large still reservoir.

Every care was taken to determine correctly the head of water in each experiment, and by such head is meant, throughout this the total depth from the surface of the still water to the crest of the the overfall. The bar forming the top of the overfall was made to r fall, and could be very accurately adjusted, by means of a hand-sc each end; to this bar, which was about 12 feet in length and 2 feet were fixed two gauge-rods, working in grooves, cut in a transverse above. The head having been determined on, the crest of the ba brought exactly level with the still water in the reservoir; the line the gauge-rods cut the top of the groove was marked with a penci the required head was also measured and marked off on the gaug A man at each end then lowered the overfall bar down to the given the water was allowed to run through the waste trunk, till it had ass an uniform regime, when, at a given signal, the lid covering the ga tank was raised, and the time of filling the tank to a given heigh accurately observed. The time was kept by two and sometimes by assistants, and it was registered to quarter seconds. The particular of obtaining the head was in some degree a matter of necessity, a from the desire to avoid the waste of water out of the canal, in the experiments.

The gauging tank had a floor of brick, laid in cement, with plank and was carefully measured; its total capacity was 444·39 cubic fe the experiments with very small heads, it was only filled to a c height; whatever leakage there was into the gauging tank, during of the experiments, was measured in a separate vessel, and in the of experiments correction is made for this, in taking the quantit charged during each experiment.

The thin plate, mentioned in some of the experiments as formir overfall bar, was a piece of iron fender plate, barely $\frac{1}{18}$-inch thic plank, 2 inches thick, was square on the top, and the broad crest was an apron formed of deal boards, roughly planed over, and fas on to the outer edges of the plank, so as to form an uninterrupted tinuation of it; the object in this case was to approximate towards constructed wide-crested weir, such as is found in rivers, &c.

The experiments tried in conjunction with Mr. Simpson, at Magna, were made on a very small reservoir, which was kept cons supplied by a pipe 2 feet in diameter, discharging from an upper voir, under a pressure of nearly 19 feet; the weather was generally sometimes rather windy, but as the place was well sheltered by walls, the effect of this was not much felt. In consequence of the dis between the discharge pipe and the overfall being comparatively (about 100 feet,) the water must have retained some part of the ve

due to its discharge under so great a head; this was perceptible to the eye, in heads above 5 or 6 inches, but the peculiar form of the reservoir prevented the amount being accurately determined. The results, however, show that this influence must have been considerable, and that the effect of water approaching an overfall with an initial velocity is an element which should never be disregarded.

Fig 3. Plan.—Scale, 40 feet to 1 inch.

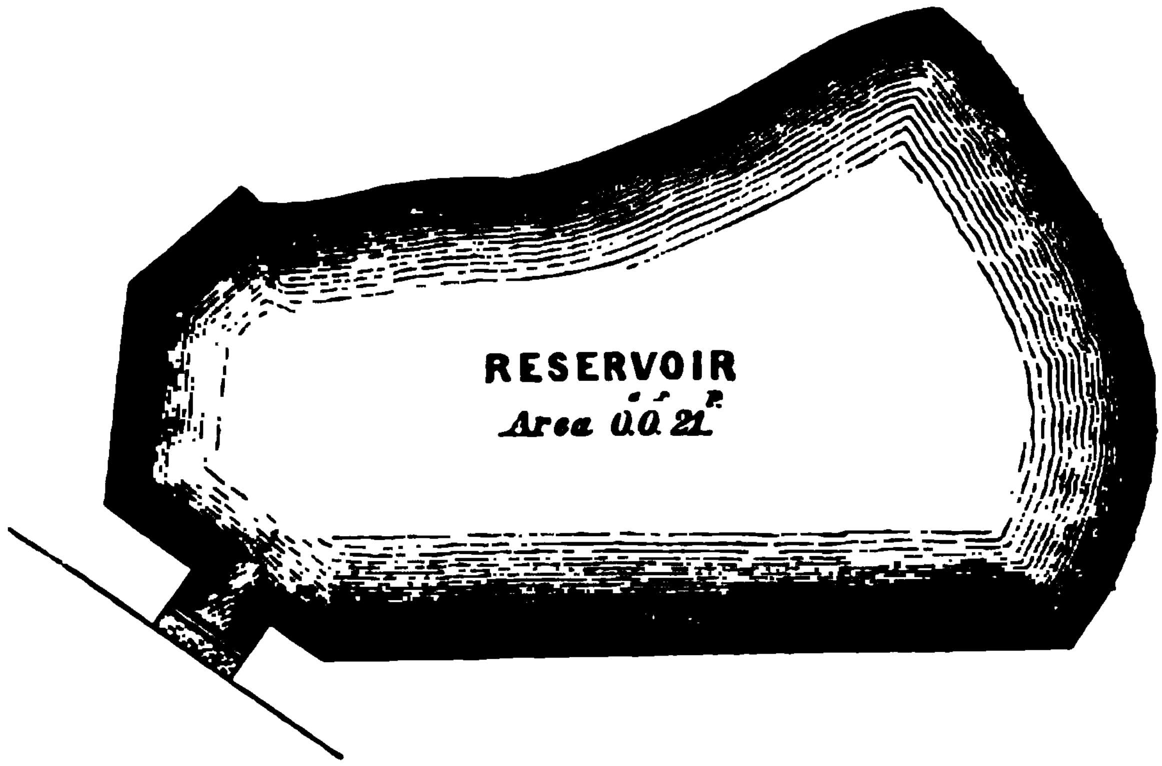
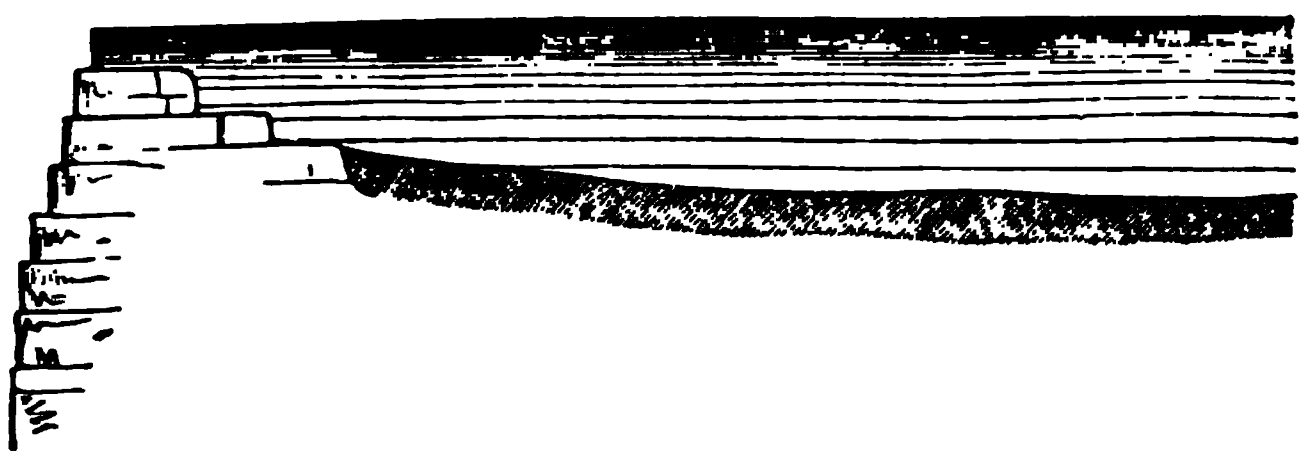


Fig. 4. Section through Overfall.—Scale, 8 feet to 1 inch.



The form of this overfall reservoir is shown in figs. 3 and 4. It had wings placed at an angle of 45°, well adapted for facilitating the discharge, and the overfall bar was a cast iron plate 2 inches thick, with a square top. The heads were measured on a bar 4 feet long, so placed diagonally in the still water that its zero was just level with the overfall top, and its upper end was raised 1 foot above. It was divided into twelve parts, which represented inches, and was again subdivided, so that each part was magnified four times, and one-sixteenth of an inch could be easily read. It was protected by a fender from the oscillations of the small waves in the reservoir. The time was kept by three and sometimes by four observers, who differed but little in their registers, of which a mean was taken. The gauging tank was a very good one, constructed for the purpose, of brick in cement, and built to hold 400 cubic feet; but by accurate admeasurement it was found to contain 389·79 cubic feet, and this quantity is used in the calculations. In this, as in the former set of experiments, efficient means, which it is not necessary to detail, were used for conveying the water from the overfall to the tank, for registering the leakage, &c.

Proceeding, then, to an explanation of the tables, it may be remarked, that the observations have been classified under the several descriptions, viz: over a plank 2 inches thick, with square edges; over a thin plate; over a crest, resembling the top of a weir, of which the breadth was 3 feet, the position of the surfaces horizontal, and also at inclinations, downwards, of 1 in 18, and 1 in 12 respectively. These main divisions were observed throughout, and the lengths of the weirs were severally 3 feet, 6 feet, and 10 feet. The first column in the table of experiments shows the head, or difference of level between the top of the overfall bar, or crest, and the level of the still water in the reservoir. The second column shows the duration of the experiment in seconds. The third column shows the absolute quantity of water discharged during the experiment, correction having been made for the leakage if any occurred. The fourth column is the reduction of the two preceding columns into cubic feet per second. The fifth is the reduction of the several results of similar experiments, with the same head and length, as shown in the former column, to an average of cubic feet per second. The sixth is a reduction of the discharge, so ascertained, into cubic feet per second, for each foot of width. The seventh column contains the coefficient of correction (m), deduced from the experiments and applicable to the formula—

$$Q = \sqrt{2gH} \times lH \times m \quad . \quad . \quad . \quad \text{(I.)}$$

in which Q is the discharge in cubic feet per second; $\sqrt{2g} = 8{\cdot}03$; H, the head in feet; l, the width of the overfall; and m, the coefficient of correction.

The eighth column contains the coefficient of correction (k), deduced also from the experiments and applicable to the formula*—

$$H^{\frac{3}{2}} \times l \times k. \quad . \quad . \quad . \quad . \quad . \quad . \quad \text{(II.)}$$

in which Q is the discharge in cubic feet per second; l, the width of the overfall in feet; H, the head in inches, or the height of the still water in the reservoir, above the crest of the overfall.

[Two columns, numbered respectively 9 and 10, were given in Mr. Blackwell's paper; but the particulars recorded not being taken in all the experiments, we have thought proper to omit them; the following may, however, be stated as the results arrived at in those which were observed]:—First, that the head of water, above an overfall, may be ascertained approximately, but only so, by the insertion of a 2-foot rule, held against the stream on the overfall bar, and observing the height to which the water rises, as the total head above the crest. Secondly, that the thickness of the blade of water, relatively to the total head, was much less than that which Du Buat assumed, in the theory on which his formula was based; which was, that this thickness was equal to half the total depth, from the crest to the top of the water. Indeed, it much more nearly agreed with the results which Professor Robison has recorded, and which he gives as about five-sevenths of the total depth. In the present experiments, it was found that, in the case of the plank overfall 2 inches wide, the thickness

*This formula is the same as that in general use among English engineers, viz: $D = H^{\frac{3}{2}} \times 5{\cdot}1$, in which D is the number of cubic feet discharged per minute for every foot in width of the overfall. H, the head in inches. 5·1 the *constant* coefficient of reduction. (The *variable* value of the coefficient (k) is, however, shown in these experiments.)

varied from six-tenths to eight-tenths, following the law of increase, as the total head increased. The exact ratios are inserted in the tables of experiments. In each of these cases, the admeasurement was taken at the outer edge of the bar, or at the lower end of the apron.

With a view of ascertaining how nearly the discharges of water follow the natural parabolic law, several curves were projected, in which the abscissæ represented the quantities discharged per second, under the various heads shown by the corresponding ordinates. From these it was seen, that though they evidently followed the fundamental law, yet the various opposing forces called into play, as the heads and widths increased or decreased, produced anomalies and variations from that curve, which entirely destroyed its regularity.

The whole of the coefficients given in the tables have been plotted, in such a manner as to show the mean coefficient for each set of experiments, and the variations for each change of head. This method shows in a striking manner, that no formula with a constant coefficient will give the true discharge of water by a weir. It is also interesting to observe, that whereas, in some instances, the coefficient is higher with a small head, and decreases as the head increases, in others the reverse takes place. Thus it will be seen, that where the overfall bar was a piece of thin plate, with a head of 1 inch, the coefficient was considerably higher than the mean; whilst a similar length of overfall, consisting of a plank 2 inches wide, gives the coefficient as much less than the mean; again, whilst the coefficient for an overfall formed of a plank 2 inches wide and 3 feet long, with a head of 1 inch, gives a coefficient of ·331, the same head and length of crest of 3 feet, gives only ·301 as a coefficient.

Experiments on Overfalls, Kennet and Avon Canal.

Overfall.	Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged.				Coefficients.	
			Total Quantity.	Per Second	Average per Second.	Per second for 1 foot in width.	m	k
Table I.—A thin Plate, 3 ft. long.	1	176½	45·97	·260	·260	·087	·451	·087
	2	124½	91·94	·739	·739	·246	·450	·087
	3	72¾	91·94	1·264	1·264	·421	·420	·081
	4	96	182·94	1·906	1·906	·635	·411	·079
	[illegible]	99½	259·01	2·603	2·603	·868	·401	·078
	6	131¼	441·77	3·366	3·366	1·122	·395	·076
						Mean	·421	·080
Table II.—A thin Plate, 10 ft. long.	1	177½	183·90	1·038	1·038	·104	·539	·104
	2	63	183·90	2·920	2·920	·292	·535	·102
	3	103½	444·39	4·304				
	3	62	260·50	4·201	4·266	·429	·428	[illegible]
	3	42½	183·90	4·352				
	4	65½	442·43	6·755	6·755	·675	·437	·089
	5	47½	442·03	9·355	9·355	·935	·433	·083
	5	47½	442·03	9·355				
	6	26	441·77	16·988	16·909	1·691	·337	·075
	6	26½	441·77	16·830				
	9	24	441·99	18·416	18·416	1·842	·353	[illegible]
						Mean	·445	·086

***Experiments on Overfalls, Kennet and Avon Canal.* (*Continued.*)**

Overfall.	Total Depth of Water above Crest, in inches	Time in seconds.	Cubic Feet Discharged. Total Quantity.	Per Second.	Average per Second.	Per second for 1 foot in width.	Coefficients. *m*	*k*
TABLE III.—Plank, 2 inches wide, 8 feet long.	1	757	137·91	·181	·180	[redacted]	·311	[redacted]
	1	280¾	45·97	·164				
	1	235	45·97	·195				
	2	167	91·94	·550	·555	·185	·339	·065
	2	164	91·94	·561				
	3	159	183·90	1·157	1·138	·376	·375	·072
	3	82½	91·94	1·114				
	3	80½	91·94	1·143				
	4	147½	259·00	1·756	1·695	·565	·366	·071
	4	158½	258·92	1·634				
	5	172½	442·67	2·566	2·537	·846	·392	·076
	5	176½	442·63	2·508				
	6	131½	443·07	3·370	3·363	1·121	·395	·076
	6	132	443·07	3·356				
	7	100½	442·38	4·402	4·413	1·471	·411	·074
	7	100	442·39	4·424				
	8	83½	442·30	5·297	5·297	1·766	·404	·078
	8	83½	442·30	5·297				
	9	70¾	442·62	6·256	6·256	2·085	·400	·077
	10	58¾	442·92	7·539	7·492	2·497	·409	·079
	10	59¼	442·99	7·445				
						Mean	·380	·073
TABLE IV.—Plank, 2 inches thick, 6 feet long.	1 to 1 6/16	487½	171·23	·354	·354	·059	·306	·059
	2	137½	184·34	1·317	1·222	[redacted]	·374	·072
	2	159	179 76	1·128				
	3	184½	439·60	2·383	2·396	·399	·398	·077
	3	183½	439·62	2·396				
	3	184	439·61	2·389				
	3	183½	439·62	2·396				
	[redacted]	181½	439·68	2·422				
	3	184	439·61	2·389				
	4	127	439·31	3·463	3·563	·594	·383	·074
	[redacted]	120	439·60	3·663				
	5	82½	442·24	5·359	5·209	·868	·401	·078
	5	86¼	442·15	5·126				
	5	86	442·16	5·141				
	6	64¼	442·72	6·890	6·890	1·150	·405	·074
	6	64¼	442·72	6·890				
	7	49¼	443·11	8·997	8·695	1·449	·405	·073
	7	51½	443·06	8·631				
	7	52	443·04	8·520				
	7	51½	443·06	8·631				
	8	43	443·27	10·309	10·309	1·718	[redacted]	·076
	8	43	443·27	10·309				
	9	37½	443·41	11·850	11·850	1·975	·379	·073
	9	37½	443·41	11·850				
	9	37½	443·41	11·850				
	10	34¼	443·03	12·950	13·156	2·193	·359	·069
	10	33¼	443·07	13·363				
	12	26¾	443·32	16·515	16·356	2·726	·350	·066
	12	27¼	443·30	16·207				
	14	20¼	443·58	21·890	22·183	3·697	·366	·071
	14	19¾	443·60	22·477				
						Mean	·377	·072

Experiments on Overfalls, Kennet and Avon Canal. (Continued.)

...rfall,	Total Depth of Water above Crest, in inches.	[redacted] seconds.	Cubic Feet Discharged.				Coefficients.	
			Total Quantity.	Per Second.	Average per second.	Per second [redacted] in width.	m	k
	1	230	152·62	·665	[redacted]	·056	·290	·056
	1	454½	207·30	·461				
	2	81½	172·62	2·125	2·129	·213	·390	·075
	2	81	172·89	2·134				
	3	47	177·51	3·777				
	3	46	177·65	3·862	3·803	·380	·379	·073
	3	48	177·38	3·695				
	3	111¼	431·38	3·877				
	4	67¼	436·53	6·491				
	4	67½	436·50	6·463				
	4	72¾	440·76	[redacted]	6·192	·619	·401	·077
	4	73½	440·72	5·996				
	4	[redacted]	440·74	6·038				
	4	73¼	440·73	6·093				
	5	48¾	438·69	8·998				
	5	50¼	438·52	8·726	8·774	·867	·406	·078
	5	51	438·43	8·597				
	6	41¾	438·72	10·512				
	6	40	438·95	10·976	[redacted]	1·088	·384	·074
	6	[redacted]	438·95	10·976				
	6	39¾	439·74	11·063	11·063	1·106	·384	
	7	32¼	440·01	13·780				
	7	33¾	439·80	13·164				
	7	32	440·04	13·887	13·720	1·372	[redacted]	·074
	7	32	440·65	13·885				
	7	32	440·65	13·885				
	8	28¾	440·48	15·474				
	8	27	440·12	16·463	15·943	1·594	·365	·071
	8	28	440·59	15·993				
	9	22½	441·33	19·613				
	9	23¾	441·16	18·575	19·417	1·942	·373	·072
	9	22	441·40	20·063				
	10	20	441·67	22·083				
	10	21	441·54	21·026	21·737	2·174	·356	·069
	10	20	442·05	22·102				
	12	15½	442·29	28·529	28·529	2·853	·356	·069
						Mean	·371	·072
... 1 in 12 [redacted] wide, 10 ft. long.*	5	45¾	442·11	9·664		0·966	·447	·086
	4	65½	441·77	6·745		0·674	·437	·083
	2	106	260·50	2·460		0·246	·450	·087
	1	190	183·90	0·969		0·097	·503	·097
						Mean	·459	·090
	1	254½	45·97	·181	·181	·060	·311	·300
	2	236½	137·91	·582	·582	·194	·355	·069
	3	170½	183·90	1·060	[redacted]	[redacted]	·359	·069
	4	[redacted]	257·75	1·404	1·404	·468	·303	·0585
	6	146½	441·46	3·014	3·014	1·005	·354	[redacted]
	7	117½	[redacted]	3·762	3·762	1·254	·351	·068
	9	85¼	442·26	5·188	5·188	1·729	·332	·064
						Mean	·338	·065

* With wing-boards converging at an angle of 64°.

Experiments on Overfalls, Kennet and Avon Canal. (Continued.)

Overfall.	Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged. Total Quantity.	Per Second.	Average per second.	Per second for 1 foot in width.	Coefficients. m	k
VIII. Crest, 3 ft. wide, 3 ft. long, sloping 1 in 18.	1	219¾	45·97	·210	·210	·070	·363	·070
	2	230¼	137·91	·597	·597	·199	·364	·070
	3	170¾	183·90	1·077	1·077	·359	·358	·069
	4	194	257·58	1·328	1·328	·443	·287	·055
	5	197½	440·44	2·230	2·230	·743	·344	·066
	7	120½	441·98	3·667	3·667	1·222	·342	·066
	8	103¼	441·81	4·279	4·279	[illegible]	·327	·063
	9	86½	442·23	5·112	5·127	1·709	·328	·063
	9	86	442·24	5·143				
						Mean	·339	·065
IX. Crest, 10 ft. long, 3 ft. wide, sloping 1 in 18.	1 to ½	282	169·90	·603	[illegible]	·060	·311	·060
	2	138¼	253·59	[illegible]	1·805	·181	·330	·064
	2	100½	178·88	1·777				
	[illegible]	83	440·24	5·304	5·304	·530	·343	·066
	6	[illegible]	442·24	10·286	10·285	[illegible]	·362	·070
	8	30	442·89	14·761	14·761	1·476	·338	·066
						Mean	·337	·065
X. Crest, 3 ft. wide, level, and 9 feet long.	1	265½	45·97	·173	·173	·058	·301	·058
	2	350	183·90	·525	·525	·175	·321	[illegible]
	3	294	260·50	·886	·886	·295	[illegible]	·057
	4	200	258·50	1·292	1·292	·431	·279	·054
	5	213½	441·19	2·066	2·066	·689	·319	·061
	6	168	441·23	2·892	2·840	·947	·334	·064
	6	65½	182·59	2·788				
	7	126½	441·66	3·486	3·466	1·162	·325	[illegible]
	7½, 8	108	441·69	4·089				
	8	107½	441·71	4·109	4·109	1·369	·318	·061
	9	89¾	442·15	[illegible]	4·926	1·642	·317	·061
						Mean	·311	·060
XI. Crest, 3 ft. wide, level, and 6 ft. long.	1 to 1½	405	173·37	·429	·429	·071		
	3	222¼	438·52	1·973	1·971	·329	·328	·063
	[illegible]	223¾	[illegible]	1·961				
	3	221¾	438·63	1·978				
	4	142	438·72	3·019	3·068	·511	·331	·064
	[illegible]	144	438·64	3·045				
	6	77½	442·88	5·781	5·781	[illegible]	·008	
	7	61¾	441·61	7·150	7·150	1·191	·331	·060
	9	44½	443·24	9·964	10·019	1·670		
	9	44	443·25	10·074				
	0	39	442·84	11·360	11·360	1·895	·310	[illegible]
	0	39	442·84	11·360				
	2	29¾	443·21	14·900	14·965	2·495	·311	[illegible]
	2	29½	443·21	15·030				
						Mean	·322	·061
XII. Crest, 3 ft. wide, level, and 10 ft. long.	1	339½	166·93	·092	·492	[illegible]	·254	[illegible]
	2	101½	178·83	1·762	1·736	·174	·319	·061
	2	104½	178·66	1·710				
	5	59¼	441·43	7·450	7·450	·745	·345	[illegible]
	6	45½	[illegible]	9·717	9·717	·972	·342	[illegible]
	8	32½	442·77	13·622	13·623	1·362	·312	[illegible]
	9	26¼	443·08	16·879	16·879	1·686	·324	[illegible]
	10	24	[illegible]	[illegible]	18·467	1·847	·303	[illegible]
						Mean	·314	·061

TABLE XIII.—EXPERIMENTS ON OVERFALLS, CHEW MAGNA.

Overfall Bar 2 inches wide, 10 feet long.

Depth of … above … in inches.	Time in seconds.	Cubic Feet Discharged. Total Quantity	Per Second.	Average per second.	Per second for 1 foot in width.	Coefficients. m	k
$\frac{7}{8}$	560½	384·71	·690	·690	·069	·394	
$1_{\frac{1}{16}}$ b	469	384·71	·820				
bare	439	384·71	·870	·860	·086	·417	
good	434½	384·71	·880				
	139¼	398·79	2·900	2·900	·290	·455	
	133¾	385·79	2·900				
ood	98¼	383·71	3·906	3·906	·391	·443	
	98	383·71	3·916				
	97½	383·71	3·916				
	97¼	383·71	3·950	4·016	·402	·447	
	97⅛	383·71	4·104				
	97⅛	383·71	4·104				
	97⅛	383·71	4·104				
	93¼	383·71	4·115	4·115	·412	·437	
	92⅛	383·71	4·148	4·148	·415	·435	
	94¼	398·79	4·231	4·231	·423	·436	
re	82	385·71	4·700	4·700	·470	·469	
$3_{\frac{1}{16}}$	80	385·71	4·820	4·820	·482	·483	
re	52½	385·71	7·340	7·340	·734		
	50	385·71	7·710				
	50	385·71	7·710	7·680	·768	·497	
	50½	384·71	7·620				
	46	383·71	8·342				
	46	383·71	8·342	8·358	·836	·495	
	45¾	383·71	8·390				
	45	383·71	8·530				
	44¼	387·75	8·770				
	43½	386·71	8·890	8·770	·877	·507	
	43⅞	386·71	8·890				
	44	383·71	8·721	8·721	·872	·494	
	41¾	383·71	9·190				
	42¼	383·71	9·090	9·017	·902	·500	
	43¼	385·71	8·870				
	43¼	385·71	8·920				
are	43¾	385·71	8·820				
are	43½	385·71	8·870	8·887	·889	·483	
ure	43	385·71	8·970				
re	34	383·71	11·290	11·290	1·129	·520	
	33½	383·71	11·460	11·460	1·146	·521	
.	31¾	383·71	12·086	12·086	1·209	·499	
to 6½	31	383·71	12·380	12·380	1·238	·501	
	31	383·71	12·380				
	28¼	*385·71*	*13·530*	13·530	1·353	·485	

TABLE XIII.—EXPERIMENTS ON OVERFALLS, CHEW MAGNA. (Continued.)

Total Depth of Water above Crest, in inches.	Time in seconds.	Cubic Feet Discharged.				Coefficients.	
		Total Quantity.	Per Second.	Average per second.	Per second for 1 foot in width.	m	k
6	27¼	385·71	14·150	14·150	1·415	·499	
6	27¼	385·71	14·150				
6 3/16	28½	399·79	14·030	14·030	1·403		
6 3/16	27¾	398·79	14·370	14·030	1·443	·499	
6 3/16	27½	398·79	14·500				
6 3/16 to 6¼	26¾	399·79	14·900	14·900	1·490	·498	
6 15/16	21¼	385·71	18·150	18·150	1·815	·515	
6 15/16	21¼	385·71	18·150				
7 21/32	20½	398·79	19·450	19·610	1·961	·478	
7 21/32	20¼	398·79	19·690				
7 21/32	20¼	399·30	19·690				
8	16½	385·71	23·380	23·380	2·338	·535	
8	16½	385·71	23·380				
8 to 8 13/16	15½	384·71	24·820	24·820	2·482	·491	
8 15/16	15½	384·71	24·820	24·820	2·482	·500	
9	14	385·71	27·550	27·550	2·755	·521	
9							
9		383·71	27·550				
					Mean	·480	

The first twelve tables give the results of the experiments made on the Kennet and Avon Canal, where the reservoir was large, in proportion to the overfall, and the water was still.

Table XIII. contains the results of the experiments made at Chew Magna, in Somersetshire, in which the reservoir was very small, in proportion to the overfall, and it was kept continually supplied by a pipe 2 feet in diameter, leading from a reservoir 19 feet above it. The columns, in this case also, have the same signification as those relating to the experiments on the Kennet and Avon Canal.

(To be Continued.)

For the Journal of the Franklin Institute.

Notice of a Railroad upon an Ice Grade. By ELLWOOD MORRIS, *Civil Engineer.*

The railroad lately laid upon a graduation of ice, provided by nature across the mouth of the Susquehanna river, at Havre de Grace, in the State of Maryland, seems to deserve a more permanent record than the fleeting notices of the daily press.

It adds another to the many striking evidences recently afforded, of the promptitude with which the mind of the American engineer and mechanic grapples with unexpected difficulties, and triumphs over them.

he railroad uniting the cities of Baltimore and Philadelphia, touches oth banks of the Susquehanna river at its mouth.

The river here is about four-fifths of a mile in width, and forming a reak in the railroad of that length, over deep water; the communication usually kept up by means of a large steam ferry boat, upon which the assengers cross from one bank to the other, independent trains with their comotives being in waiting upon both banks.

The passengers themselves debark, when they reach the river, and gain e boat through covered buildings, which screen them from the weather; eir baggage, with the car containing it, is run upon the upper deck, and eing carried over is replaced upon the railway on the further bank, and oupled to the train in waiting there.

Now the river Susquehanna, leading to the north, in bleak and moun- inous regions, brings down in the winter season, great quantities of oating ice, which seriously impede the railroad ferry.

At the mouth of the river there is shoal water, in which the ice grounds, id in severe weather, it forms a point of support for successive floating asses, until it sometimes gorges up for many miles above the ferry of e railway line.

In forming these "*gorges*" of ice, the cakes edge up, and freezing to- ther in that position, form a mass of great solidity and strength, but ry rough upon the surface.

While this gorge is forming, the railroad ferry is necessarily discontinued, d when it has formed, the question arises—how is the business of the ilway to be resumed?

These preliminary remarks bring us now to our main subject: In a se- re winter like that of 1851-2, the engineer of the railway sees his ferry e at Havre de Grace cut off, and the river filled almost to the bottom th a vast accumulation of cakes of ice, a foot thick, edged up, and frozen that position, so as to present a mass of great strength, but most bidding superficial aspect.

Contemplating this with the true eye of science, and seeing its adapta- n to his purpose, Mr. Trimble, the engineer of the railroad company, termined to form over this rude glacier, *a railroad* for his baggage and ight cars, and *a sledge road* along side of it, upon which two horse sleighs uld carry his passengers, and by means of towing lines, propel the ight cars over the river. This was the great idea, and most promptly d successfully has it been carried out.

The first step was to *locate* the railroad; for upon this rough surface of e, a straight line between the ferry landings, would have required too uch graduation; too much excavation and embankment, (so to speak,) ice and snow.

The line was accordingly staked out with several curves, so as to duce the labor required in grading the frozen surface; the projections, ints, and ridges were cut away, and broken fragments of ice were used fill up the hollows. Then upon condemned ties, about four feet apart, ith some new timber interspersed, a track was laid with U rails, of out 40 lbs. to the yard, confined merely by hook-headed spikes, and ithout chairs.

The surface of the ice *being some 10* or 15 feet below the permanent

rails upon the two banks, was gained by temporary inclines, running off from the shores upon a rough blocking of cob work, so arranged as to be adjustable, and taking advantage of a low pier on the left bank, to reduce the grade. These inclines, and the track across the ice, were connected with the main line on both banks, by suitable switches, and formed in fact a species of sideling nearly a mile long. Upon the inclines the baggage and freight cars were worked one way by *gravity*, and the other by *roping*, from the locomotive train. Forty freight cars per day, laden with valuable merchandise, have been worked over this novel track by the means above referred to, and were propelled across the ice portion by two horse sleds running upon the *sledge road*, and drawing the cars by a lateral towing line, of the size of a man's finger.

At the present writing, this novel and effectual means of maintaining the communication at Havre de Grace, is still in successful operation, and will so continue until the ice in the river is about to break up. Then by means of the sledges, the rails, (the only valuable part of the track,) can be rapidly moved off by horse power, not probably requiring more than a few hours time, so that the communication may be maintained successfully until the last moment. If properly timed, (as it doubtless will be,) the railroad may be removed, the ice may run out, and the ferry be resumed, it may be, in less than 48 hours.

We cannot conclude this brief notice by an eye witness, without expressing our admiration of the ingenious practical arrangement, adopted for overcoming an extraordinary difficulty at this point, by Isaac R. Trimble, Esq., the engineer of the railroad company.

---

*The Submarine Telegraph.**

At about half past 10 o'clock on Thursday morning the last portion of the wire leading from the Foreland was brought close under the walls of the Castle at the summit of the cliff, and thence gently dropped into the garden attached to the temporary office of the Company. The wire was then led into one of the upper rooms and connected with the telegraphic instruments. In addition to the well known apparatus of Messrs. Cooke and Wheatstone, the more modern inventions of Messrs. Brett and Henley had been enlisted for the occasion. After some little delay, consequent on the rapidity with which the arrangements were made, the wires were finally connected, and it became a moment of intense anxiety when signals were about to be passed. The instrument of Messrs. Cooke and Wheatstone was set in motion, signals were interchanged with Calais, and the complete success of the undertaking was completely evinced. But very few communications had passed when a mounted messenger arrived with a despatch from the telegraph office of the South Eastern Railway Company. It proved to be a communication containing the prices of the funds on the London Exchange, which were to be immediately sent on by the submarine telegraph to Paris. The particulars of the message were of course kept secret, but it was gratifying to observe that it was duly forwarded. From this time despatches were continually passing between the Dover telegraph offices and London and Paris. A message from

*From Herapath's Railway and Com. Journal, No. 649, November 15, 1851.

London was sent to Paris and an answer received from Paris and forwarded to London within one hour, and this time, it must be remembered, includes the distance of a mile traversed twice between the Dover offices, bringing the London message to the office of the Submarine Company and transmitting the reply to the office of the South Eastern Railway. To this must be added the loss of time consequent on the message having to be sent from the Paris office to the Paris Bourse, and the time taken for the reply from the Bourse to the Paris office.

AMERICAN PATENTS.

List of American Patents which issued from January 13, to February 3, 1852, (inclusive,) with Exemplifications by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

25. For an *Improvement in Machines for Scouring Knives and Forks;* Christopher Aumock, Columbia, Ohio, January 13.

Claim.—"I claim the construction of this machine, composed of two cylinder brushes, with their peripheries in contact, which causes the friction necessary for scouring or polishing, and at the same time keeps the cylinder brushes, which do the work of polishing or scouring, wet with the polishing substance continually, while the machine is in motion, by immersing the under side of said brushes in the liquid as they revolve around on their axis, as above mentioned. The article to be scoured or polished must be held in a perpendicular position, and moved up and down between the cylinder brushes while in the act of scouring or polishing."

---

26. For a *Blind and Shutter Operator;* James R. Creighton, Cincinnati, Ohio, January 13.

Claim.—"Having thus fully, clearly, and exactly described the nature, construction, and operation of my improvement in window blind openers and fasteners, what I claim therein as new is, the sliding extension rod, provided with the bent arm or hook, groove, notch, and tooth, as described, in combination with the staple, catch, and serrated neck, fitting into a corresponding socket in the plate; whereby the shutter or blind is opened or closed by manipulation from the inside, and retained in position when opened, by the fallen bent arm in the staple, and when closed, by the introduction of the bent arm into the notch in the catch, the serrated neck, with its corresponding socket in the plate, preventing the bent arm from being dislodged from either position, by tampering from the outside."

---

27. For an *Improvement in Running Gear of Carriages;* Gustavus L. Hausskneclit, New Haven, Connecticut, January 13.

Claim.—"I do not claim the separate use of one segment, on which the end of the perch rests; neither do I claim two pivots attached to the body: but what I do claim as my invention is, the placing the pivot in the rear of the forward axle, in combination with the two sets of segments or circles, viz: segments A, and segments D, seen at fig. 3, or their equivalents, substantially as above described."

---

28. For an *Improvement in Apparatus for Cutting the Pile of Piled Fabrics;* John Johnson, Assignor to Elias Johnson, Troy, New York, January 13.

Claim.—"What I claim as my invention is, the method of connecting the cutter (one or more) with the carrier by means of a joint, substantially as specified, in combination with the guide or feeler (one or more), substantially as specified, whereby the guide or feeler is carried down, to determine the position of the cutter or cutters, before it or they begin to cut, as described.

"I also claim connecting the cutter or cutters and the feeler or feelers with the reciprocating carriage, by means of a *spring joint, substantially* as specified, so that the tension

of the spring, or its equivalent, shall draw the feeler or feelers against the range of loo to be cut, to insure the proper position of the cutter or cutters relatively to the range loops to be cut, as specified.

"And finally, I claim the method of operating the cutters and guides or feelers towar and from the face of the cloth, and towards and from the lay, by connecting the ways o which the carriage runs, by arms, to the arms of a rock shaft, and to two inclined rockin joints, substantially as specified, whether the rock shaft be operated by the means specifie or the equivalents thereof."

---

29. For an *Improvement in Lanterns;* Philos Blake, New Haven, Connecticut, Janu ary 13.

"My improvement consists in attaching to the bottom of a lantern of any known o suitable construction, an additional appendage, whereby the lantern is made to rest securel and in an upright position on the top of the fore-arm of the person who carries it; thereb having both hands at liberty to perform manipulations, and at the same time presentin the light in the proper position for that purpose."

Claim.—"What I claim as my invention is, the combination of a lantern of any con struction, with the additional appendage herein described and set forth, for the purpose o adapting the same to be carried on the top of the fore-arm, and of keeping it in an uprigh position. And this I claim, whether said appendage be constructed in the particular form and manner set forth, or in any other manner whereby the same object is accomplished by substantially the same means."

---

30. For an *Improvement in Ornamental Painting on Glass, &c.;* John W. Bowen Brookline, Massachusetts, January 13.

"My process imparts to a painting on glass, an appearance very much like those figure which are executed on wood or papier mache, and which are more or less, or in part, mad up of pieces of mother of pearl let into the wood. The paintings or figures produced b my said method have very beautiful properties of reflecting light, such as are often exhibit ed by silvered prismatic or crystaline surfaces."

Claim.—"What I claim as my improvement in ornamenting surfaces, consists in com bining with the process of painting and ornamenting, by metallic foil, that of corrugatin or crimping the foil, so as to impart to the figure or figures a power of reflecting light, s as to produce the sparkling, scintillated appearance, as specified."

---

31. For an *Improvement in Machines for Dressing Stone;* Albert Eames, Springfield Massachusetts, Assignor to Charles T. Shelton, City of New York, January 13.

"My invention relates to improvements on the machine for dressing stone, secured b letters patent granted to Charles Wilson, bearing date the 13th day of March, 1847, an re-issued 4th March, 1851."

Claim.—"What I claim as my invention is, making the upper surface of the ways elastic substantially as described, in combination with the cutter carriage, constructed and opera ting in manner substantially as specified and for the purpose described.

"I also claim the manner, substantially as described, of mounting the stone carriage o wheeled axles, so that it can be elevated and depressed, in combination with the feedin platform, running on ways, substantially as described, so that the carriage can be run o wheels, to bring stones to and remove them from the machine, and be let down on to th platform, to receive the feed motion, as described.

"And, finally, I claim the dogs jointed to and in combination with the jointed arms substantially as described, so that by means of wedges, or their equivalents, the block o stone can be adjusted and secured in place, as described."

---

32. For an *Improvement in the Shakers of Winnowing Machines;* Henry Filburn Dayton, Ohio, January 13.

Claim.—"What I claim as my invention is, the method of moving the shaker finger in the manner and for the purposes herein set forth."

33. For an *Improved Ornamental Connexion of the parts of an Iron Fence;* Henry Jenkins, Cincinnati, Ohio, January 13.

Claim.—"Having thus fully described my improvements in manufacturing fences, what I claim therein as new is, connecting the parts of a wrought iron fence to each other, by casting iron ornaments upon them, for the purposes of ornamenting and fastening the parts together, substantially in the manner herein described."

---

34. For *Improvements in Beveling Planes;* Harrison W. Lewis, Bath, New York, January 13.

"This invention consists of a plane, or planing instrument, of peculiar form and furnished with several peculiar devices, so as to be adapted to the purpose of forming at one operation, and with extraordinary accuracy, a double bevel upon the grooved edge of a stile or rail of a panel door."

Claim.—"What I claim as my invention are, 1st, the adjustable gauge bar and the vertical adjustable guide, in combination with the double faced plane stock, all constructed and relatively arranged as herein described.

"2d, The combination of the guard screws, guard stock, adjustable guard, gauge bar, vertical guide, and plane stock; the whole being constructed and arranged, substantially in the manner and for the purpose herein set forth."

---

35. For an *Improvement in Looms for Weaving Piled Fabrics;* Charles A. Maxfield, Troy, New York, January 13.

Claim.—"Having thus described my invention and improvement in the loom for weaving pile fabrics, I wish it to be understood, that it is not my intention to claim the use of the figuring or pile wires, upon which the loops or pile is raised; but what I do claim to have invented is, 1st, the employment on each side of the loom, of a wing, constructed substantially as described, when mounted upon either end of the lay, rock shaft, moving independent thereof, and of each other, and vibrating alternately with each other, in the arc of a circle scribed from the said rock shaft, and upon each are mounted the ways of the pile or figuring wires, whereby the said wires are carried rearward, to be re-inserted into the open shed, and thence forward to the last pick of the woof, or weft, as described.

"2d, I also claim causing the wings to recede, to carry the wires to the open shed, and then advance frontward with the wires to the woven pile, alternately, by the action of the lay itself, each wing being locked to the lay at the proper moment, and disengaged therefrom on the insertion of the wire, by the action of the curved lever as described.

"3d, I likewise claim pivoting the ways of each wing, and furnishing the inner ends thereof with arms projecting into openings in the breast beam, whereby the ways, with the figuring wires, are made to maintain a horizontal position, during the vibration of the wings, in the arc of a circle, as described.

"4th, I also claim providing each wing with a holding lever, pivoted to the frame and vibrating with the motion of the wing, and locked by means of a spring plate and pivoted arm, actuated by the advance motion of the double arms of the rock shaft, when the wire is at rest in the warp, whereby the wing is retained steadily in its position, until the withdrawal of the figuring wire.

"5th, I also claim combining the intermediate sliding arm, horizontal rods, with the carrier and wire, whereby the middle of the latter is sustained and prevented from trembling, whilst being inserted and withdrawn from the web, as described."

---

36. For an *Improvement in Machines for Making Sugar Candy;* Bartholomew O'Brien, Rochester, New York, January 13.

Claim.—"What I claim as my invention is, making candy by machinery substantially as set forth."

---

37. For an *Improvement in the Apparatus for Attaching pieces of Metal to each other, by Casting;* Horatio B. Osgood, Thompsonville, Connecticut, January 13.

"My improvement consists in making the jaws movable, so that they may be adjusted

to their proper positions, or changed for different shaped steel, when required, and so as to allow the levers to shrink, without any risk of straining the castings."

Claim.—"What I claim as my invention is, the use of movable jaws attached to the permanent parts of the flask, for the purpose of holding the steel pivots, or bearings, of levers and beams of platform scales and other analogous articles, firmly in the exact position required for use, while the fused iron or other metal is being poured into the mould, so as to fix them securely in the lever, &c., and so that the movable jaws will readily yield to the shrinkage of the metal while cooling, and prevent any injury from straining any of the parts, when the whole is constructed, arranged, and fitted to operate, substantially as herein described."

---

38. For an *Improvement in Buckwheat Fans;* Alfred Platt, Waterbury, Connecticut, January 13.

Claim.—"What I claim as my invention is, the method of separating the hulls from the kernels of buckwheat, by shaking them on a table, or tables, made slightly concave and rough, substantially as specified, in combination with a current or currents of air blown over the surface of such table or tables, to carry off the hulls, whilst the kernels are retained or held back by the form of the surface of the table or tables, as specified."

---

39. For an *Improvement in Machinery for Punching Sheets of Metal;* Samuel Lanford, Fall River, Massachusetts, January 13.

Claim.—"What I claim as my improvement is, the combinatiou of the hinged flaps, M M, and their levers N N, restoring springs and tripping studs, or equivalent mechanic contrivances, with the movable carriage and the punching cylinders or mechanism; the whole being arranged and made to operate substantially as herein before specified."

---

40 For *Improvements in Apparatus for Moulding in Flasks;* Edward Satterlee, Albany, New York, January 13.

Claim.—"Having thus fully described the parts and combination of parts, and operation of the moulding machine, what is claimed therein as my invention is, the making of moulds, in and by the alternate motions of a sifter, sliding knife to cut off the sand when the flask is filled, press, and movable bed, connected with and worked by the continuous motion of a single shaft, substantially as described in this specification."

"I do not cliam the sifter or press as my invention.

"I also claim as my invention, the moving, stopping, and starting of the bed, to and from the points, where the operation of sifting, filling, and pressing the sand are done, by the continuous rotary motion of a single shaft, substantially as described in the specification.

"I also claim the method of striking the surplus sand from the top of the flask after the curb is removed, by means of a self adjusting bar or knife, substantially as described and set forth in this specification."

---

41. For an *Improvement in Metallic Heddles;* Jacob Senneff, Philadelphia, Pennsylvania, January 13.

Claim.—"What I claim as my invention is, casting the eye on the wire which constitutes the heddle, harness, or heald, through which the warp passes, in the manner and for the purpose set forth, producing a heddle much superior to any other known or used, and which will remove many of the difficulties heretofore experienced, in the use of the common twisted wire heddle."

---

42. For an *Improvement in Turning Prisms, &c.;* Allen Sherwood and Avery Babbett, Auburn, New York, January 13.

Claim.—"What we claim as our invention is, the prismatic lathe herein described, consisting, essentially, of a rotating cutting instrument, whose cutters, in rotating, combine to describe a figure whose longitudinal sections are the counterparts of the outline of the *longitudinal sections* of the figure to be produced, and of a carriage to hold the block in

such a position, that its axis is always parallel with that of the cutting instrument, and at the same time, to move it transversely to the same, for the purpose described, and allow it to be turned on its axis at pleasure, and to be held from turning, while being acted upon by the cutters."

---

43. For *Improvements in Machines for Splitting Rattan;* Joseph Sawyer, Royalston, Massachusetts, January 20.

Claim.—"Having thus fully described my invention, what I claim as new is, the employment, in combination with the cutters for splitting off the strands, of feed rollers or their equivalents, having grooves of the form of an angle or certain of the sides of a polygon, of which the edge or edges of the knife or knives form another side or other sides, substantially as and for the purposes herein described."

---

44. For an *Improved Process of Mashing Maize;* Frederick Seitz, Easton, Pennsylvania, January 20.

Claim.—"Now what I claim as my invention and improvement in the brewing and distilling business is, the above specified preparation and boiling of the corn for brewing and distilling, boiling it to a jelly before the malt or rye is mashed into it, giving a much larger than the usual yield from cheaper material, enabling me to use one-half to two-thirds corn for beer, ale, and porter, and to make 19 quarts of whiskey from 60 pounds of corn, (including the usual quantity of malt only, and no rye,) and 21 quarts, with rye, as specified."

---

45. For *Improvements in Planing Machines;* G. W. Tolhurst, Cleveland, Ohio, January 20.

Claim.—"Having thus fully described my invention, I would state, I am aware that the stocks and cutters of planing machines have been made to yield upon an axle, the centre of which is in line with the cutting edge of the knife. This I do not claim; but what I do claim is, hanging the stock at a line above the edge of the cutter, to a spring or weighted lever, in the manner described, in combination with the resting of the front part of the stock upon a fixed surface, so that when the back part of the stock is made to rise, the whole stock is thrown forward and upward, thus keeping the edge of the cutter at the same level, notwithstanding the change in its angle with the bed."

---

46. For an *Improvement in Grain Harvesters;* Thomas Van Fossen, Lancaster, Ohio, January 20.

Claim.—"Having thus fully described my invention, what I claim therein as new is, constructing the reel with hinged or jointed slats, having teeth projecting from them, whereby the grain is more effectually collected, raised, and drawn into the action of the cutters, substantially as described.

"I also claim the combination of the teeth with the sliding platform, which teeth rise and fall at the desired time, alternately, arresting and releasing the cut grain, whereby the reciprocating motion of the platform will keep the cut grain strait, and constantly moving on the platform towards the trough, substantially as described."

---

47. For an *Improvement in Canal Locks;* W. W. Virden, Havre de Grace, Maryland, January 20.

"The nature of my invention refers to the economizing of water, in passing canal or other boats from one level to another, and consists in the use of plungers or floats working in suitable chambers, provided with appropriate passages and wickets connecting them with the lower level, to which plungers the boat in its passage through the lock is attached, so that in falling to the lower level, the weight of the boat is made to force up the water in the float chambers to the higher level, thus contributing to the latter level an amount of water to sustain the loss by the quantity passing off the lower level."

Claim.—"What I claim as my invention is, causing the weight of the descending boat to act as a supplying power to the higher level, by the use of plungers or floats, (any number,) fitting in suitable chambers, provided with appropriate passages, and communicating

with the higher and lower levels for operation, in the manner essentially shown and described."

48. For an *Improvement in Spring Mattresses;* John Waters, Southwark, Pennsylvania, January 20.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, the method herein described of securing the springs of spring mattresses to the frame and to each other, so as to leave the tops of the springs free to play or yield to any pressure, viz: by connecting them together by a riveted leather hinge, and allowing the longitudinal and cross pieces of the frame to pass through a slot in said leather hinges, the whole being combined and arranged in the manner and for the purpose set forth."

49. For an *Improvement in Mills for Grinding Quartz;* Horatio Blasdell, City of New York, January 20.

"The distinguishing feature of improvement consists in so constructing and combining the several parts of the mill, that the quartz rock shall be received and cracked or reduced so as to pass between the grooved surfaces of the semi-spherical runner and concave, wherein the quartz is held, and the particles thereof made to act by friction directly upon each other, and thus effect its own pulverization, and allowed to descend gradually to circular channeled rings, between whose surfaces the quartz is reduced to the fineness of flour."

Claim.—"Having thus described my mill for reducing gold quartz rocks to a powder or flour, what I claim as new is, the combination of the chilled hollow cylinder R^2, and nut S, of the form represented, and the grooved chilled rings W E^2, and horizontal circular channeled chilled ring plates R X, with the grooved concave E, and runner T, for breaking, pulverizing, and powdering gold quartz rock; the said chilled rings and plates being arranged and operating in the manner and for the purpose herein fully set forth."

50. For an *Improvement in Churns;* Edwin B. Clement, Barnet, Vermont, January 20.

Claim.—"What I claim as my invention is, the application to dashers for churns, of floats that shall close together at their appointed place, when pressed downwards through the cream or milk, forcing the cream or milk through narrow spaces, and opening again when raised from the bottom; claiming the right of composing the dasher of any materials, and in any combination of the above described parts, so as substantially to produce the same effects."

51. For an *Improvement in Machines for Drilling Stone;* Henry Goulding, Boston, Massachusetts, January 20.

"My improved machine is intended to be used either as a power or hand drilling machine, and is so constructed as to drill in any direction, the drill being set in a swinging frame, and operated by the friction of two sets of grooved wheels, with movable journals, so placed with regard to each other as to turn the drill as it is driven."

Claim.—"Having thus described my improved drilling machine, what I claim as my invention is, 1st, driving the drill forward and back by adjustable wheels, between the edges of which the drill shaft is placed, substantially as above described.

"2d, I claim turning the drill, by placing said wheels at an angle to each other, substantially as herein above described.

"3d, I claim feeding the drill forward, as the hole is deepened, by making the bearing surface of the wheels which drive the drill in, of greater strength than that of the other wheels."

52. For an *Improvement in Washing Machines;* John McLaughlin, Goshen, Ohio, January 20.

Claim.—"Having thus fully described the nature, construction, and operation of my improved washing machine, what I claim therein as new is, the method of hanging and operating the plunger, by means of the shackles and the heavy counterpoise handle, as described."

53. For an *Improvement in Hand Printing Presses;* Henry Moesser, Pittsburg, Pennsylvania, January 20.

"The object of the represented arrangement is to avoid the sliding motion of the platen, as it is most generally the case with hand presses; for that purpose, the tympan plate is constructed movable around the hinges, and the impression effected from below, by pressing the platen with the types against the tympan, as will be shown."

Claim.—"What I claim as my invention is, the tympan plate of a printing hand press, removable by hinges, and counterbalanced, together with the manner of holding the tympan plate in its position. (when lowered down,) for the purpose of resisting effectually the pressure exercised from below, substantially as described."

54. For an *Improvement in Spinning Machinery;* Oliver Pearl and Henry P. Chandler, Lawrence, Massachusetts, January 20.

Claim.—"But what we do claim as our improvement is, the arrangement of the whirl at the base of the flyer, in combination with making the said whirl and the bearing on which the whirl is placed and rotates, with a passage through them large enough to allow the bobbin to play within the same, and up and down between the flyer legs, substantially in manner and for the purpose as specified."

55. For an *Improvement in Self-Sharpening Grindstones;* Jesse Pennabecker, Elizabeth Township, Pennsylvania, January 20.

Claim.—"What I claim as my invention is, the combination of a grindstone with a self-acting picker, by which the grindstone is sharpened by its motion or power, as herein described, or in any other manner substantially the same."

56. For *Improvements in Nail Machines;* Samuel G. Reynolds, Worcester, Massachusetts, January 20.

"The object of my invention is to avoid the difficulties heretofore encountered in the manufacture of wrought iron nails, and consists in the employment of cutters to sever tapered pieces, by cutting from a plate, rolled to the required thickness of the thickest part of the shank of the nails, and making the taper alternately from opposite sides, and so proportioned that the cross section, taken at any part of the shank, shall have the same or nearly the same amount of metal after the cut, and when the nails are completed, when this is combined with griping or moulding dies, which receive the cut pieces from the cutters by some suitable conveying means, and which mould them by causing the metal to spread, instead of elongating, and retain the same or nearly the same amount of metal in any and all parts of its length."

Claim.—"Having thus described my improved method or process of making wrought nails, and the machinery for the same as I have essayed it, I wish it to be distinctly understood, that it is susceptible of modifications, as for instance, instead of making an active pressure on all four faces of the blank, to give the required form, the same thing may be accomplished, although not so well, by making active pressure on two faces, and simply presenting resistance to the other two faces.

"What I claim as my invention in the making of wrought nails is, the employment of the cutter for cutting wedge-formed pieces from a previously rolled plate, of equal or nearly equal thickness, substantially as described, preparatory to and in combination with the moulding dies which receive the cut pieces, by suitable conveying apparatus, from the cutters, and mould them to the required form by pressure, substantially as specified, so as to give the form by spreading the metal between the dies, instead of by elongation, as heretofore practised when making nails from cut blanks.

"I also claim the vibrating cutter, and the faces or dies for confining and compressing the nails arranged on both sides of the said cutter, substantially as described, when this is combined with the two stationary cutters, having a space between the two, through which the rod or plate of iron is fed, substantially as described."

57. For an *Improvement in Brick Kilns;* William Linton, Baltimore, Maryland, January 20.

"My improvements consist in the form of the bottom of the fire arches, and in the mode

of introducing the air into the furnace, for igniting and burning the fuel, and causing a free, steady, and unimpeded heat, equalized throughout the body of the kiln, by which I am enabled to greatly economize the fuel, and burn a kiln of bricks, or other articles manufactured of clay, more evenly and expeditiously than by any other mode with which I am acquainted."

Claim.—"Having thus fully described my improvements, what I claim therein as new is, forming air arches or openings in the kiln, between the fire beds, with lateral openings therein, through which a sufficient amount of air can be supplied equally to all parts of the fire bed at the same time, substantially as herein described."

---

58. For an *Improved Cast and Wrought Iron Blind;* Robert White, Washington, District of Columbia, January 20.

Claim.—"I do not claim the combining cast and wrought iron, nor do I claim to be the first to have cast metal round cold metal, and joining the same by that means; but what I do claim as new is, producing a new product or article of manufacture for shutters, doors, &c., whereby I am enabled to use wrought iron slats, and prevent the contraction of the metal, in cooling, from warping the same, by casting the top, centre, and bottom plates separately and distinct from the side plates, and running the side plates to the slats and plates, substantially as herein set forth."

---

59. For an *Improvement in Piano Forte Action;* Geo. Brown, Assignor to Geo. Brown and John Munro, Boston, Massachusetts, January 27.

Claim.—"I therefore claim in the upright piccolo piano forte action, the arrangement of the back catch lever L, in front of the back catch, and so that the rear side of the bearer shall operate in connexion with the front side of the back catch."

---

60. For an *Improvement in Sand Paper Holder;* Azel H. Copeland, West Bridgewater, Massachusetts, January 27.

Claim.—"Having thus described my invention, I shall state my claim as follows: what I claim as my invention is, the implement called a sand paper holder, constructed substantially as above described; that is, of two similar pieces of wood, with handles at the ends, the inner sides flat, and the other sides rounded, joined together lengthwise by a hinge of cloth or leather, so that the flat sides can be brought together; the outer edges of the flat sides having small wire pins inserted in them, by which the sand paper is held, and the two pieces being held together, when closed by dowels in one of the flat sides entering corresponding holes in the other flat side."

---

61. For an *Improvement in Mill Spindles;* Egbert T. Butler, Buffalo, New York, January 27.

"My invention relates to spindles for mills, in which the runner stone is held to its work by pressure, and consists in making and uniting the parts of the spindle where they connect to the driver, and connecting them to the driver in such a manner as to secure solidity, compactness, durability, and ease of operation, by the means hereinafter described."

Claim.—"Having thus fully described my invention, I claim, 1st, Uniting the upper and lower parts of the spindle, by means of the driving chuck or key, made substantially in the manner and for the purposes herein set forth.

"2d, I do not claim the vibrating centre separately, but I do claim it in combination with the driving chuck or key, and the method herein described, of uniting the parts of the spindle."

---

62. For *Improvements in the Ring Spinner;* Geo. H. Dodge, Attleborough, Massachusetts, January 27.

Claim.—"What I claim as my invention is, the combination of the standard or projection B, with the ring and traveler, substantially in manner and for the purpose of removing or loosening waste from the latter, as specified."

63. For *Mechanism for Operating the Relief-Valve in Partially Condensing Engines;* William Few, St. Louis, Missouri, and Francis Armstrong, New Orleans, Louisiana, January 27.

Claim.—"Having thus described the construction and operation of our invention, what we claim therein as new is, the arrangement and combination of the partial escape or relief-valve W^2, plate Z, reciprocating lifting box Y, connecting rod *j*, crank lever X, and rock shaft T, whereby the said relief-valve W^2, is actuated simultaneously with the opening of either of the exhaust valves, and allowed to close again, as herein set forth."

---

64. For an *Improvement in Cooking Ranges;* John P. Hayes, Boston, Massachusetts, January 27.

Claim.—"Having thus described my improvements in cooking ranges, I shall state my claim as follows: What I claim as my invention is, the combination of the pipes, arranged with fire spaces between them, with the hot air flues and driving flues of the brick work on the back and side of the oven, by which hot air is circulated through the oven, and back again to the chamber about the fire pot, and so on continuously, this hot air being used either for baking or for heating the apartments of the house.

"2d, I claim the use of swing doors, arranged one on each side of the front of the fire pot, serving for radiating surfaces, in connexion with the said front of the fire pot, for roasting purposes, and to admit the cold air when opened, as herein above described and set forth."

---

65. For an *Improvement in Water Metres;* Samuel Huse, Boston, Massachusetts, January 27.

Claim.—"What I claim as my invention is, combining with a cylindrical case, such as herein described, and provided with induction and eduction passages, and with a segmental stop and leather cap plate, for packing, substantially as described, a series of hinged segmental pistons, hinged to arms projecting from a central shaft or hub, and hinged at about one-third of the distance from their inner ends, so that when thrown open, their outer ends shall not bind against the inner periphery of the cylinder, and when closed to pass the segmental stop, they shall be sustained by a rest projecting from the central shaft or its equivalent, having a space between them and the shaft and arms for the free flow of water, or other fluid, under the said pistons, to admit of their closing freely; the whole being made and combined substantially in the manner and for the purpose specified."

---

66. For an *Improved Nail Plate Feeder;* Caleb Isbister, Allegheny City, Pennsylvania, January 27.

Claim.—"What I claim as my invention is, 1st, The giving to the nail plate, an interrupted rotary motion in the same direction, instead of the reciprocating, partially rotating motion in opposite directions, usually given to said plate, and this I claim irrespective of the mechanical devices by which said motion is communicated.

"2d, I claim the combination of the sectional cog-wheel always moving in the same direction with the cylindrical cog-wheel, having irregular teeth, working between guides, having a mouth piece, and with the springs and spring plate, or their equivalents, by means of which, both an interrupted rotary and a rising and a falling motion is communicated to the nail plate.

"3d, I claim giving a continuous forward and an interrupted forward and backward motion to the nail plate, by means of the revolving shaft, screwed tube, cam and guide pin, and nut, *w*, combined with each other substantially as herein described."

---

67. For *Improvements in Iron Railings;* Benjamin Kraft, Reading, Pennsylvania, January 27.

Claim.—"What I claim as my invention is, the method of constructing a self-adjusting and fastening fence, by forming the posts in two pieces, substantially such as herein described, making two sides of one part of the post, with mortises at the top and near the bottom, for the reception of the rails, and the other piece, when in place, retaining them in position.

"I claim the tongues, I I, connecting the hollow cap J, provided with a tongue K, and groove K, with the uprights, or panels, *o o*, said tongues passing between the rails, and with the cap J, serving as a hook to sustain the uprights or panels."

---

68. For an *Improvement in Railroad Switches;* Abm. S. Miller, Republic, Ohio, January 27.

Claim.—"Having described the nature of my invention, what I claim is, placing the tumbler, figures 4 and 5, under the rails L and K, in such a manner as to ease their movement, and when at rest, operating as a brace, or key, to retain the rails in place."

---

69. For *Improvements in Fire-Arms;* Charles V. Nickerson, Baltimore, Maryland, January 27.

Claim.—"Having thus described my improvement in fire-arms for loading at the breech, where the barrel is banded or secured to the stock, I wish it to be understood that I make no claim to being the original inventor of a fire-arm, or gun, loaded at the breech, such as that patented in France, to Mr. Tourrette, of Paris, on the 24th November, 1834, described in "*Brevets d'Inventions, Vol.* 55," and in descriptions of other guns which are loaded at the breech, patented and unpatented; but what I do claim as new is, dividing the stock at the junction of the barrel and breech, and mounting the barrel and that portion of the stock to which it is attached, with a sheath or case, upon a longitudinal bar or tongue, projecting from the but of the stock, as represented in the drawings, whereby the stock and barrel are allowed to have a movement from the breech, for inserting the cartridge into the chamber thereof, and returned and locked by a catch to confine them together."

---

70. For an *Improvement in Shingle Machines;* Luther B. Parker, Pine Township, Pennsylvania, January 27.

"The nature of my invention consists in an improvement in Woods's patent self-feeding shingle machine, for cutting and jointing shingles; this improvement consists in this—I do not use the machinery for self-feeding, but in my improvement you feed by hand."

Claim.—"What I claim as my invention is, the application of the vibrating and gauging the shingles. The shingle blocks are laid on the bench, and are pressed against the vibrating rod, one end resting against the centre panel of the knife sash; then as the sash moves up and down, the shingles are cut off the block and finished at one stroke of the machine, while the block can be turned at leisure, to suit the grain of the wood."

---

71. For *Improvements in Ships' Davits;* Charles Perley, City of New York, January 27.

Claim.—"I do not claim any of the separate parts themselves, but I do claim as new and of my own invention, the application of the socket *d*, on its hinge 5, in combination with the socket *c*, and davit *e*, for the purposes and as described and shown."

---

72. For an *Improvement in Neck Yokes;* John T. Plato, Jasper, New York, January 27.

Claim.—"Having thus described my invention, what I claim therein as new is, the combination of the washers C, the swivel B or E, bolt *a*, and nut D, with the ordinary neck yoke, arranged in the manner and for the purpose herein set forth."

---

73. For an *Improvement in Railroad Switches;* Ira Reynolds, Republic, Ohio, January 27.

"The nature of my invention consists in attaching radial links, or arms and swiveled levers, to the stay bar connecting the switch rails, in such a manner as to secure a perfect change, and lock for the same."

Claim.—"I do not wish or intend to claim the placing or attaching of links, arms, or tumblers, under the switch rails, or stay bars, for the purpose of carrying them over; but what I do claim is, 1st, the attaching of the links or arms to the stay bar, or switch rails, and superstructure, for the purpose of holding the switch rails against the undue action of the levers, and securing them in a perfect and uniform motion, when acted upon by the

levers, also to act as a stay or lock, which shall effectually hold and secure the switch rails, in every position, substantially as set forth.

"2d, I claim a combination of the pivoted levers, furnished with peculiar formed ways, with the operative shoe, so constructed and arranged, that the switch rails are moved upward and laterally, in manner substantially as described."

---

74. For an *Improvement in Windlasses;* Amzi C. Semple, Cincinnati, Ohio, January 27.

Claim.—"What I claim as my invention in the above described press is, winding the rope upon a screw with a concave score between the threads, that fits the rope and supports it in its proper form, thereby lessening the wear of the rope and its liability to be broken, in the operation of pressing, when the said screw is made to work through a fixed nut, so as to always draw the rope in the same position, substantially as described."

---

75. For an *Improvement in Shears;* John C. Symmes, West Troy, New York, January 27.

"This invention relates to an improvement in the pivot, by which the edges are drawn together sideways, in cutting, and all inconvenience arising from the looseness of the pivot, in ordinary scissors and shears, is effectually remedied."

Claim.—"What I claim as my invention is, making the pivot and the hole in one or both limbs in which it fits, of such form as exemplified at O, as to cause the edges of the blades to be drawn together sideways, by the power applied in cutting, as herein fully set forth."

---

76. For an *Improvement in File Cutting Machines;* James H. Thompson, Paterson, New Jersey, January 27.

Claim.—"What I claim as my invention is, 1st, the traveling and revolving elongated elliptical cam, in combination with the connecting rod or its equivalent, communicating a varying amount of motion to the rock shaft, which motion is conveyed, through suitable mechanism, substantially such as is described, to the screw, by means of which a varying rate of travel is communicated to the chisel.

"2d, The inclined plane, or its equivalent, in combination with a jointed chisel stock, or its equivalent, pressed against said plane by the spring, or its equivalent, substantially as described.

"3d, The springs, or their equivalents, to press the axis of the stock into the scores in the sliding bar.

"4th, The springs, or slide and spring, whether used separately or combined, to press the cross against the pillars, so that the file may remain upon the bed, in that position in which it is placed, by one stroke of the chisel, until it is struck again, thereby dispensing with the roller heretofore used to press the file against the bed."

---

77. For *Improvements in Machines for Making and Sizing Paper;* Geo. W. Turner, London, Great Britain, January 27.

Claim.—"What I claim as my invention is, 1st, the application of the endless wire web, in combination with and passing round the cylinder, and taking the pulp up from the vat, and carrying it forward, and submitting it to the action of the dandy roller and pneumatic trough, taking the place of the fixed wire web and endless felt in the cylinder machines now in use, and the wire web upon which the pulp flows in the above mentioned Fourdrinier's machine. I am aware that a somewhat similar combination is found in Millbourn's machine, reported in *Repertory of Patent Inventions*, 5th Series, Vol. 9, p. 325, dispensing with the cylinder D; but that I do not claim.

"2d, I claim the method of passing the paper through a trough of size, between two endless felts, or other fabrics, as above described, thereby obtaining a perfect and uniform saturation of the paper, and protecting the paper from all injury, during the process of sizing and pressing."

---

78. For an *Improvement in Burglar Alarms;* L. J. Worden and E. H. Space, Clinton, New York, January 27.

Claim.—"We do not claim the clock movement, as that is a well known and old inven-

vention; neither do we claim the lever K, for the purpose of operating upon the pallet F; but what we do claim as new is, the securing of the lever K, after it has been moved by the button M, so as to allow the pallets F, F, to be acted upon by the 'scape wheel D; said lever K being secured by the end *m*, of the lever, N, fitting in a groove or recess, *o*, in the end *j* of the lever K, the end *m* being forced into the groove or recess *o*, by the spring *n*, substantially as shown and described."

Re-issue for January, 1852.

1. For an *Improvement in Planing Machines;* Charles A. Spring and Peter Boon, Kensington, Pennsylvania; patented July 30, 1850; re-issued January 13, 1852.

Claim.—"Having thus fully described our improved machine, we wish it to be understood, we do not claim a bench that can be raised and lowered by set screws, or similar device; but what we do claim as our invention is, 1st, hinging the bed-piece at one end, and raising and lowering it at the other, in combination with the revolving cylindrical cutter, in the manner and for the purpose set forth.

"We also claim the combination and moving of the feed rollers (g') with the stationary ones, by the oblique links and gear, as described, the whole being constructed and operating as before specified."

Designs for January, 1852.

1. For a *Design for Stoves;* James G. Abbott and Archelus Lawrence, Philadelphia, Pennsylvania, January 6; ante dated December 11, 1851.

Claim.—"What we claim as new and of our invention is, the design or ornament, shape and configuration of stove plates, as represented in the annexed drawings at D E F, figs. 1, 2, 3."

---

2. For a *Design for Stoves;* James G. Abbott and Archelus Lawrence, Philadelphia, Pennsylvania, January 6; ante dated December 11, 1851.

Claim.—"Having thus described and represented our new design of stove plates for "the Complete Cook," what we claim as new is, the design and configuration of ornamental stove plates, substantially as described and represented at A B C D E F G H I J, of the accompanying drawings."

---

3. For a *Design for Stoves;* Sanford Burnam, Waterford, New York, January 6.

Claim.—"Having thus described the design of my stove, what I claim is, the design and configuration of ornaments, arranged and combined substantially the same as represented."

---

4. For a *Design for Spoons;* Henry Hebbard and John Polhamus, City of New York, January 6.

Claim.—"Having now described our invention of a new and ornamental design for spoons or other articles, what we claim as our invention is, the use of the ornamental design, substantially as herein set forth, for the purpose of ornamenting spoons, forks, or other articles to which it may be applied."

---

5. For a *Design for Stoves;* William Savery, City of New York, January 6.

Claim.—"What I claim as new and original is, the design and configuration of the several ornamental figures on the front and bottom plates of a certain stove, as represented in the annexed drawings and as above described."

---

6. For a *Design for Stoves;* J. Harvey Conklin, Peekskill, New York, January 6.

Claim.—"What I claim as my invention is, the configuration and design of the several ornaments and their mouldings, particularized on the front, sides, doors, legs, and feet of the stove, formed and arranged as depicted and described."

7. For a *Design for Stoves;* James Wager, David Pratt, and Volney Richmond, Troy, New York, January 13.

Claim.—"Having thus fully described our design, what we claim therein as new is, the foregoing described configuration of the plates, forming an ornamental design for a stove, as represented and illustrated by the drawings."

---

8. For a *Design for Floor Oil Cloth;* James Paterson, Assignor to James Allen, Elizabethtown, New Jersey, January 13.

Claim.—"What I claim as my invention is, the representation of trunks of trees and landscape, as in the accompanying drawings, for a design for floor oil cloth."

---

9. For a *Design for Coal Stoves;* John Burgess, Assignor to Geer, Chaffee & Richmond, Troy, New York, January 13.

Claim.—"Having thus described and represented my new design, what I claim is, the design and configuration of a cast stove, substantially the same as described and represented in the annexed drawing."

FEBRUARY, 1852.

1. For an *Improvement in Hemp Brakes;* Lewis S. Chichester, Williamsburgh, New York, February 3.

Claim.—"What I claim as my invention is, making two or more breaking and cleaning cylinders, with fixed rods at or near their peripheries, and radial plates made to slide radially, (or some of them fixed,) operated substantially as herein described, in the spaces between the rods, substantially as described; the two or more cylinders being geared together so as to turn with equal velocities, and so placed, that in their rotation, the rods and plates of one cylinder shall come opposite to those of the other cylinder, for the purpose and in the manner substantially as set forth.

"And I also claim the combination of springs substantially as described, with the sliding plates of the cylinder or cylinders, operated substantially as herein described, for the purpose of rendering the plates self-adapting to the material introduced, and insure its being properly griped, and held so as to admit of slipping, without undue strain on the fibres, as described."

---

2. For an *Improvement in Grass Burners;* John A. Craig, Columbia, Arkansas, February 3.

Claim.—"What I claim as my invention is, the application to the surface of the ground, flame for agricultural purposes, using for that purpose, the above described machine, or any other substantially the same, which will, by heat, produce the intended effect."

---

3. For an *Improvement in Feeders for Planing Machines;* Jno. Cumberland, Mobile, Alabama, February 3.

"This machine as constructed, is composed of two general parts: The first consists of a stationary plane or bed-piece; and the second of a movable platform, which is subject, for the purposes of description, to further division, as will appear hereafter."

Claim.—"What I claim is, my above described combination of a bed-piece with the spring, lever, connecting rod, arm, tumbler and clicks, and its grooves, guides, and rack, with a movable platform, with the adjusting levers and ratchets, for the production of a lateral traverse and lost motion, with its adjustable table, adjusted by springs, weights, screws, or other known means, with its hand wheels, rollers, vertical ratchets, and balance clicks, and of a frame with its pully and half wheel, for the purpose of delivering or receiving material thereon; the whole being constructed, combined and operating as above set forth and described, and for the purposes mentioned."

4. For an *Improvement in Street Sewers;* Willard Day, Brooklyn, New York, February 3.

Claim.—"Having thus described the nature of my invention, and the manner in which it operates, what I claim as new is, the combination of the basin placed at the bottom of the inclined drain, and at the side of the sewer, with a single man hole, so placed as to give access to the basin and sewer."

---

5. For an *Improved Door Spring;* Henry Hochstrasser and Abrm. Masson, Philadelphia, Pennsylvania, February 3.

Claim.—"We do not claim the straight piece of steel for a spring, as new, neither do we claim having the spring act most powerful when the door is closed as new; what we do claim as new and our invention or improvement is, the application and mechanical arrangement of a curve, in connexion and combination with a spring and rollers, for the purpose of a door spring, whose power will be exerted more strongly when the door is closed, or about closed, than when open entirely or partially, as herein described."

---

6. For an *Improvement in Gas Purifying Apparatus;* Abram Longbottom, City of New York, February 3.

"My invention relates to certain improvements in the method of purifying illuminating gas, whereby the washing apparatus is wholly done away with, so that the gas comes from the retorts or furnaces, completely purified and ready for consumption."

Claim.—"What I claim as my invention is, purifying the gas, by passing it through a mixture of equal measures of quick lime and of animal charcoal, in the same retort in which the gas is generated, but at a temperature, so regulated, that at the lowest point, or where the gas enters the composition, the mass is at a lowered heat; and at the top, or where it leaves the composition, the heat is below redness, substantially in the manner herein set forth."

---

7. For an *Improved Method of Keeping the Valves of Oscillating Engines upon their Seats;* Ephraim Morris, City of New York, February 3.

Claim.—"I claim the pressure plugs, or their equivalents, acting against the caps, or their equivalents, in combination with the steam chest, valve, and valve seat or, seats, vibrating with the steam cylinder; said plugs operating to keep the valve or valves on to the seat or seats of the same, as described and shown."

---

18. For an *Improvement in Axletree Arms;* David Philips, Sharon, Pennsylvania, February 3.

"The object of my invention is to obtain the advantages of wooden and iron axletrees in the same wagon, and it consists in a compound arm and cap, which is formed of metal, and is applied to the extremity of a wooden axletree, so that the wagon wheels rotate upon iron arms of small size, and, consequently, with a small amount of friction, while the elasticity of a wooden axletree, and the advantages incident thereto, are retained."

Claim.—What I claim as my invention is, constructing metallic arms for axletrees, with sockets and ribs, as herein set forth, so that the arm can be attached to the wooden stock, or body of the axletree, without the employment of the hoops, clips, and screw bolts heretofore employed, even when the stock is as small, or of less diameter than the arm."

---

9. For an *Improvement in Concentrated Beer Material;* Franz G. Rietsch, Rudoletz, Austria, February 3.

Claim.—"What I claim as my invention is, the new and useful preparation of matter herein described, termed, Zeilithoid."

10. For *Improvements in Ships' Blocks;* William and Stephen G. Coleman, Providence, Rhode Island, February 3.

Claim.—"What we claim as our invention is, the method of making ships' blocks, by placing the metal straps edgewise, that is, with its greatest breadth in the direction of the plane of the axis of the sheaves, and extending from the sides of the sheave to the outside of the cheeks, substantially as specified, when this is combined with the attachment of the cheeks in segments to the wide faces of the straps, substantially as specified.

"And we also claim making the cheeks of ships' blocks in segments of a ring, substantially as specified, whereby the elongated form is obtained, by simply turning in a common lathe, whilst apertures are left each side of the straps, to give admission for cleaning and oiling, and for checking or stopping the sheave, as fully set forth."

---

11. For an *Improvement in Running Gear of Railroad Cars;* Henry Davis Taylor, Newark, New Jersey, February 3.

"This invention relates to certain means of removing obstructions from the track, and preventing the cars, engine, or any carriages employed on railroads, from being caused to run off the track by any unevenness or obstruction, that does not admit of being easily removed, or by any other means."

Claim.—"I do not claim the grooved inclined wheels, J J, fitting to the rails in the manner described; but what I do claim as my invention is, the lower truck or frame, supported upon the rails, and prevented from rising, by grooved inclined wheels, fitting to the edge of the rails, and connected to the trucks and body of the car, by series of links and rods, substantially such as are herein described and represented, operating for the purpose set forth.

"And I also claim the forked guards provided with elastic bands, attached to the lower truck, so as to move up and down freely, but formed so as to take a firm bearing or rest on the front axle, or any stationary part of the front truck, when brought into contact with any obstruction, substantially as and for the purpose herein set forth."

---

12. For an *Improvement in Running Gear of Carriages;* Charles F. Verleger, Baltimore, Maryland, February 3.

"The nature of my invention consists in an improved arrangement of the running gear of four-wheeled carriages, whereby I am enabled to produce a light and strong carriage, all four wheels being of equal size, which can be turned round with ease, and without danger of upsetting, in a space of about the diameter of one of the wheels."

Claim.—"Having thus fully described my improved running gear for four-wheeled carriages, and the advantages attained by the same over all others, when the object is to turn in as small a space as possible, without running the fore wheels under the body of the carriage, what I claim as new therein is, the combination of the segment plate *c*, and the perch *e*, sliding thereon and connected with the axles, as described, with the segment plate *h*, forming a part of the perch *e*, and the plate *i*, attached to the perch block of the body, and sliding on the plate *h*, in connexion with the rods *a a*, by which the other parts are regulated and governed in their action, constituting an arrangement of running gear, constructed substantially as in the manner herein fully set forth and represented."

---

13. For an *Improved Steering Apparatus;* Norman W. Wheeler, Buffalo, New York, February 3.

Claim.—"Having thus described my improved steering apparatus, what I claim therein as new is, the combination of fast and moving circular racks, of different diameter, with corresponding planet wheels or pinions, connected together and actuated by the hand wheel, as herein set forth."

---

14. For an *Improvement in Bridges;* Ammi White, Boston, Massachusetts, February 3.

Claim.—"Having thus described the whole construction of the bridge, I wish it to be understood, that I do not claim, separately, as new, the mode of constructing the stringers, by splicing and securing planks in the manner set forth and shown; nor yet do I claim, separately, the use of diagonal planking, crossed in layers, as described; nor yet, again, do

I claim, by itself, increasing the width of the roadway and other parts of the bridge at th ends; neither the mere employment of side guards or braces; as all these, or similar de vices or applications, belong to common carpentry or ordinary bridge building; they, how ever, are necessary details, or contain principles essential to the construction of my bridge involving a combination having the effects and advantages specified.

"But what I do claim as my invention is, 1st, The combination of parts, constructe and arranged as described, in formation of a wooden tubular suspension bridge; that is the several suspension stringers D D, of catenary form, and constructed and united i pieces as explained, (the outer ends of the extreme stringers being locked, as represente in the back stays,) the stringers H H and I, for construction thereto or thereon of the in clined roof, made of diagonal planking; the roadway stringers G G, connected by suspen sion rods to D D and H H; the direct arch M, united by suspension rods, and further direc arch N, bearing under the upper stringers, together with the transverse floor timbers an roadway; the bridge thus constituted, being formed—that is, its stringers, arches, an coverings—of short pieces of wood, united, and having their fibres running in appropriat directions, as shown, and the bridge being in form wider at its extremities, gradually na rowing towards the centres; by which combination and arrangement of parts, the tensil strength of the wood in the suspension stringers is fully employed, vertical and later vibration are reduced, the roof more than assists towards the support of its own weigh and the bridge may be extended over a considerable space.

"2d, The continuous angular side guards formed by fender raves P P, inclined rafte Q Q, diagonal plank covering R R, and extensions of the transverse roadway timbers O (the said side guards projecting most, and being of greatest extent at the extremities of th bridge, gradually diminishing towards the centre; and the specified side guards serving no only as braces to reduce the lateral motion, but as a covered roadway, and to break th effect of wind upon the structure."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Remarks on the Screw Steamship "City of Pittsburg." By Chief Enginee B. F. Isherwood, U. S. N.

The new steamship *City of Pittsburg*, bought to trade between Phila delphia and Liverpool, has made her first voyage out under steam, an on her return has had the misfortune to break the three blades of her screw propeller. Understanding it to be the intention of her owners to use differ ent proportions for her new screw, it will be of interest to know the perform ance of the vessel with the old one. The dimensions given in this articl were furnished me by her able Engineer; the results were taken from th steam log of the vessel.

HULL.

Length on Deck,	266 feet.
" Water Line,	249 "
Beam on Deck, extreme,	40 " 9 inches.
Depth of Hold,	32 " 6 "
Deep Load of Draft,	$22\frac{1}{2}$ feet forward. 23 feet mean. $23\frac{1}{2}$ feet aft.
Draft with coal half out,	$21\frac{1}{4}$ feet.
Immersed Amidship Section of vessel at $21\frac{1}{4}$ feet draft,	800 square feet.
Burthen, Custom House measurement,	3370 tons.

The hull was originally intended for paddle wheels, and was designe with flat floor and sides, not being the model proper for screw propellers

ENGINES.

Two vertical trunk condensing engines.

Diameter of Cylinders,	85½	inches.
" Trunks,	39	"
Being equivalent to a cylinder having a diameter of	76·09	"
Stroke of piston,	51	"
Space displacement of both pistons per stroke,	267·392	cubic feet.
Mean effective steam pressure per square inch of piston,	10·4	pounds.
Total power developed by the engines,	777	horses.

SCREW.

One of cast iron; not a *true* screw, but twist bladed.

Diameter,	16 feet 2 inches.
Pitch at hub,	30 "
" periphery,	36 "
Mean pitch in function of total surface,	33 " 6 "
Fraction of pitch used,	0·563
Length on periphery,	5 feet.
" hub,	3 feet 2 inches.
Total helicoidal surface,	126 square feet.
Total surface projected on a plane at right angles to axis,	110·5 " "
Number of blades,	3.

RESULTS.

The vessel steamed from Philadelphia to Liverpool, in November, 1851. Total distance by observation, 3480 geographical miles of 6140 feet. Total time of steaming the above distance, 17 days, 4 hours, or an average of 8·447 geographical miles per hour. Total number of revolutions of the screw, 790,070, or an average of 31·96 per minute. Average steam pressure in the boiler, 10 pounds per square inch above the atmosphere; cut off at $\frac{4}{5}$ths the stroke from the commencement. Throttle one-fourth open. Lift of valve reduced one-half. Vacuum in condenser, per gauge, 19 in. of mercury.

The weather throughout was fine, with an ordinary sea, and a moderate wind forward the beam. No sail set.

Total consumption of fuel, 519 tons, 1677 pounds, or 2825·8 pounds per hour of Cumberland (bituminous) coal.

SLIP OF THE SCREW.

Practically, the effective propelling portion of the screw is about that comprised between the diameters of 6 feet 2 inches, and 16 feet 2 inches, or the exterior 5 feet radially of each blade.

The average pitch of this surface in function of surface is 34 feet.

From the foregoing data, the slip of the screw will be as follows, viz:

$8·447 \times 6140 = 51864·58 =$ speed of vessel per hour in feet.
$34 \times 31·96 \times 60 = 65198·40 =$ " screw " "

$13333·82 =$ slip of screw " " or 20·45 per cent.

BOILERS.

Three iron boilers, of the double return drop flue variety, placed side by side.

Total amount of heating surface, ...	8028 square feet.
" " grate "	226 " "
Aggregate cross area of upper row of flues, . .	28·4 " "
" " " middle " " . . .	37·6 " "
" " " lower " " . .	28·4 " "
Area of smoke chimney, ...	37·6 " "
Height of chimney above grate, ...	59 feet 6 inches.
Consumption of coal per square foot of grate per hour, .	$12\frac{1}{2}$ pounds.
Pounds of sea water evaporated per hour per pound of coal, inclusive of loss by blowing off, supposing the cylinder pressure to be 7 lbs. per square inch above atmosphere, caused by throttling, ...	4·93 pounds.

PROPORTIONS.

Proportion of heating to grate surface, . . .	35·52	to 1·00
" heating surface per cubic foot of space displacement of both pistons, ...	3·00	"
" heating surface per cubic foot of space displacement of both pistons multiplied by number of double strokes of piston per minute, . .	0·94	"
" grate surface per cubic foot of space displacement of both pistons, ...	0·85	"
" grate surface per cubic foot of space displacement of both pistons multiplied by number of double strokes of piston per minute, . .	0·026	"
" cross area of upper row of flues to grate surface,	7·96	"
" " middle " "		
" " lower " " .	7·96	"
" " chimney to grate surface, . .	6·01	"

The loss by "blowing off" has been calculated on the supposition that the water was carried at $\frac{2}{32}$ of Sewell's Salinometer, with which instrument the boilers were fitted. This is a maximum loss. The evaporation has also been calculated for only 3 lbs. *less* steam pressure in the cylinder than in the boiler; though the steam was wire drawn, both at the throttle, which was but one-fourth open, and at the valve, which had but half its proper lift.

The evaporation obtained of only 4·93 pounds of water per pound of coal, although exceedingly low, was what might have been anticipated from the above proportions, which gave a maximum of heating to grate surface, viz: 35·52 to 1·00, reducing the temperature of the gases delivered into the chimney so low, as necessarily to produce a very sluggish draft; while the proportion of *least* calorimeter, or cross area of flue, to grate surface was only 7·96 to 1·00; a proportion entirely too small, with the low velocity of draft, to supply the proper quantity of atmospheric air for combustion. The inevitable result of such proportions is, that the constituents of the coal is not fully oxidized, and of course a large portion of the products of combustion pass off in the form of carbonic oxide, instead of carbonic acid gas.

Boilers of such proportions should contain double the present amount of grate and heating surface, to supply these engines for driving a screw of the present pitch and surface, in which case a high rate of speed could be obtained.

The present mean effective pressure per square inch of piston is 10·4 pounds, with steam of 7 pounds initial pressure. Supposing now that steam were supplied of 14 pounds initial pressure in the cylinder, cutting

f at $\frac{3}{8}$ths, as at present, and instead of the present vacuum in the conenser, the usual one of 26 inches were carried: the mean effective presire per square inch of piston would then be 19 pounds; and as the imber of double strokes made by the piston (with the same load) is as e square roots of the pressures on it, the double strokes would be ineased in the proportion of 31·96 to 43·18, and the speed of the vessel creased from 8·447 to 11·41 geographical miles per hour. The conimption of fuel, with boilers of the same proportions as the present ones, upposing enough of them to furnish the cylinders with steam of 14 ounds above the atmosphere, cutting off at $\frac{3}{8}$ths,) would be just doubled, r equal to 60 tons of coal per 24 hours steaming. The time of making e passage would be reduced to 12 days, 17 hours, and the consumption f coal for the passage, instead of 520 tons, would be 762 tons.

It is very doubtful, however, if the engines are adapted for making 43 ouble strokes of piston; and a better result would probably be obtained y making a true screw of 37 feet initial pitch, expanding to 43 feet, eing a mean of 40 feet, and adding another blade to compensate the fective surface lost by increasing the pitch, retaining of course the preent length of screw on axis, or even increasing it by 6 inches, if practiable. The slip would then remain about the same as at present. The ngines have so much cylindrical capacity that, with the increased pitch f screw, they could still, with the above consumption of fuel, develop ifficient power to make the passage in the reduced time stated.

It is of course understood, that the foregoing conclusions do not prend to critical accuracy; but it is believed they are sufficiently near the uth for any practical purpose.

It has frequently been stated that high speed cannot be obtained with screw propeller, and an instance challenged where speed has been iven by it to a large vessel, equal to the speeds obtained from fast ocean eamships, like the Collins' and Cunard liners; but I think the results furished from the *City of Pittsburg*, a vessel probably of equal resistance the steamers of these celebrated lines, will be found as high, comparing em with the actual powers applied to the propelling instruments.

With the Collins' steamers, there is required to make a 10 days 20 ours passage from New York to Liverpool, a mean effective steam presire of 19 pounds per square inch of piston, furnished by a consumption about 83 tons of coal per 24 hours, cutting off at $\frac{3}{8}$ths. The space disacement of both pistons per stroke is 888.03 cubic feet. Mean number double strokes per minute, 14$\frac{1}{2}$. Allowing then the mean effective essure in the cylinders of the *City of Pittsburg* to be 19 pounds per uare inch, and the double strokes of piston per minute 43·18, the owers and results would compare as follows, viz:

	Powers.	Speeds.	Cube of Speeds, or Results.
Collins, . . .	1·115	1·039	1·122
City of Pittsburg, . .	1·000	1·000	1·000

The foregoing is, of course, but an approximation obtained from genel data; but it is sufficiently close to demonstrate that the screw will, for ean steamships of very deep draft, give equal speeds with equal power,

compared to the paddle wheel, provided it be properly proportioned and well managed.

The screw has never, to my knowledge, been tried in a first class ocean steamship, with any approximation to the power that is applied to the paddle wheels of such vessels; of course, the reason is obvious why as great speeds have not been obtained.

General Proportions of Power and of Surface of Screw to Immersed Amidship Section of Vessel.

Square feet of immersed amidship section of vessel		per cubic foot of space displacement of pistons,	2·992	to 1·000
Do.	do.	per cubic foot of space displacement of pistons multiplied by number of double strokes of piston per minute,	0·093	"
Do.	do.	per square foot of area of screw, viewed as a disk, ...	7·240	"
Do.	do.	per actual horse power developed by vessel,	1·030	"

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* Dr. L. Turnbull.

Continued from page 111.

The House Printing Telegraph.

This instrument has been appropriately termed one of the wonders of the age; its apparent intricacy of construction arises not so much from the use of electricity and magnetism, as from the number of minute physical contrivances, and the various methods by which they are brought into action.

Of the origin and life of the inventor, Mr. Royal E. House, it seems difficult to obtain any definite or conclusive information; while the results of his labors are spread before the public, form a prominent object of its curiosity, and are made subservient in a high degree to its utility, the man himself seems almost a recluse, and veiled, as it were, from the sight of the world. If some tell us that he originated in New York, more authentic sources affirm that he was born in Pennsylvania, and reared among the Green Mountains of Vermont. To the old Keystone, then, may we ascribe the honor of having given birth to one who has achieved so much in the progress of American artizanship.

To converse and carry on intelligent discourse at the distance of many hundreds of miles, is not new; nay, it has become common; but to impress with the subtile electric spark through vast space, solid material, with the symbols of our language in the fulness of their proportionate beauty; to make the cold, dull, inanimate steel speak to us in our own tongue, surpasses the mythological narratives of ancient Greece and Rome, throws into the shade the fabulous myths of superstitious Arabia, and sinks into insignificance the time honored traditions of the Oriental World.

A letter dated Boston, Dec. 23, 1850, received in reply to some inquiries, relative to Mr. House, affords the following interesting information: "Mr. House is a self-educated man, and was engaged nearly six *years in perfecting* his instrument; he is decidedly scientific, but not learned,

having devoted much attention to electricity and its kindred sciences; observing the property of a helix or coil of wire to attract an iron bar to its centre, he proceeded to make some practical application of the fact, and succeeded in constructing what is termed an axial magnet; his principal object then, was the construction of a machine adapted for its use, which he fabricated after many attempts and much perseverance.

Such is the cast of his intellect, that he could form the entire object in his mind, and retain it there until he had completed its whole arrangement, without committing any thing to paper; somewhat abstract in disposition, he is careless about money, little communicative concerning himself, capable of long protracted thought, and completely absorbed in his hobby, the telegraph; to such an extent is this abstraction carried, that he often forgets his most faithful and puctilious business promises, and when sought after to comply with them, is found investigating some interesting object of science, or deeply engrossed in thought; even with particular friends he is very reserved about himself.

From some affection of the eyes he was confined to his dwelling during most of the time spent in contriving his instrument; he resides at present in New York. An application was made for a patent in 1845 or '46, but it was refused on the ground that some of the specifications clashed with those of Mr. Morse; one, however, was granted in October or November of 1848, to date from April 18, 1846.

The stations between which communications are conveyed, are connected by means of a circuit composed of one conducting wire, (see J, fig. 47,) and the ground; the wire is insulated to prevent escape of the electric fluid by enclosing it throughout its whole length in tubes of guttapercha: the heat of the sun melts this covering, or renders it so soft as to destroy its form, and it has been abandoned by all the lines except one; most of them employ, now as at first, the naked wire, supported on glass knobs fixed with bits of muslin to iron spikes driven into the post; they were formerly made of twisted wire and wound around glass knobs; thus exposed to the atmosphere, they soon became .oxidized, requiring frequent repairs, or the lightning by striking them often played many pranks with the machines and their operators; the action of the current was also very unequal, owing to the varying electrical conditions of the atmosphere.

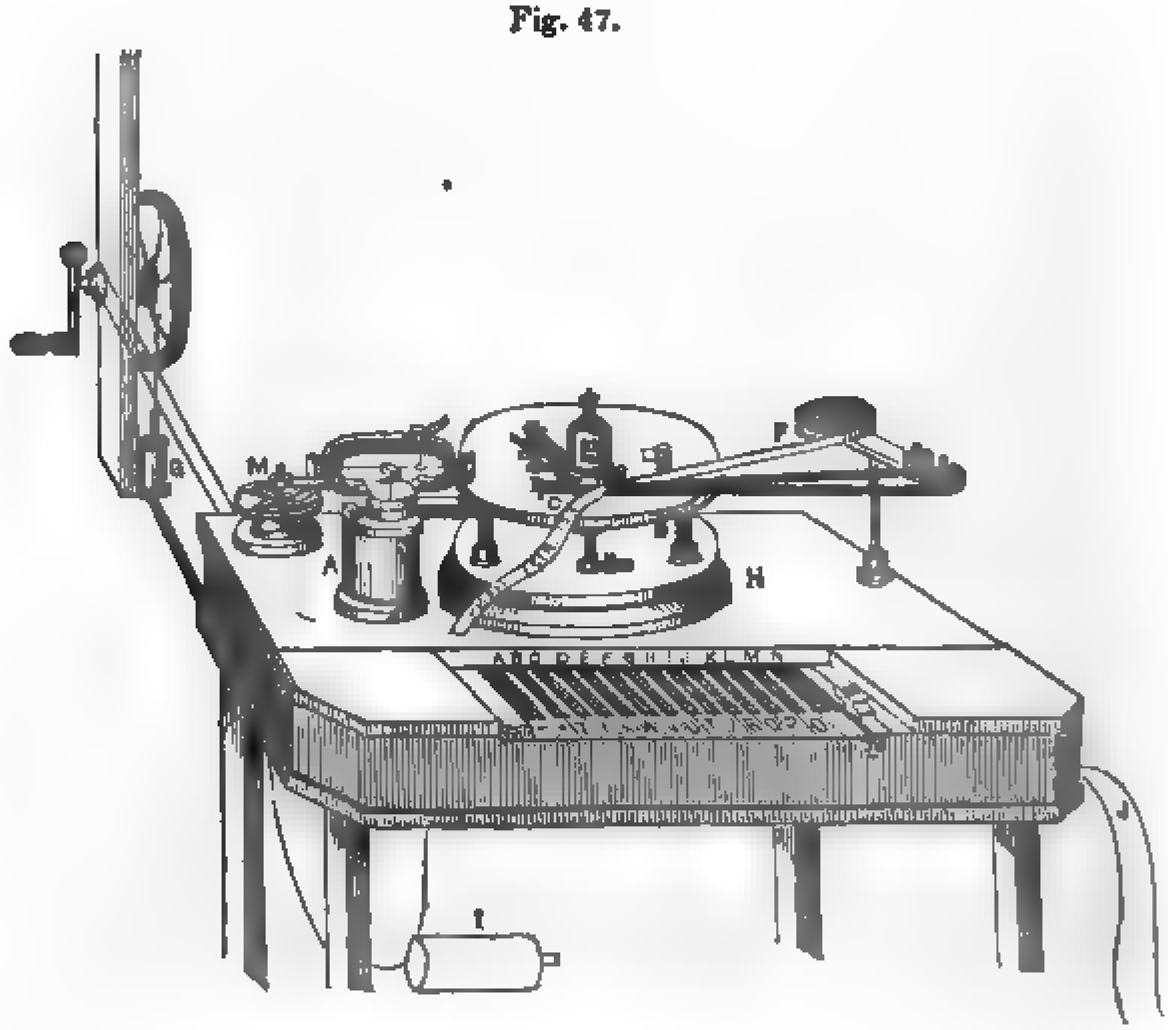
Notwithstanding all their precautions, a severe accident of the above nature, occurred to the House Telegraph in this City, on the 29th of May last; during a severe thunder storm in the afternoon of that day, the lightning, as was supposed, struck the line about six miles from the city; it destroyed nearly three miles of wire, melted off the helix of the magnet here, and terminated with a loud explosion at the battery; several gentlemen were sensibly and severely affected, and one of the operators, Mr. Alexander, received a heavy shock, causing vertigo, ringing in the ears, nausea, and temporary insensibility.

The posts to sustain the wire, are from 20 to 30 feet in height, set 5 feet deep, nine inches in diameter at the base, four and a half at the top, and about 15 rods distant from each other, that being the medium length which the kind of wire cited will support of itself and be durable; the Grove battery is employed to generate the current, of which about thirty cups are necessary for a distance of 100 miles.

The main constituents of his telegraph, are the composing machine, the printing machine, a compound axial magnet, a manual power which sets the two machines in motion, and a letter wheel or tell-tale, from which messages can be read when the printing machine is out of order.

A composing and printing machine are both required at every station; the printing apparatus is entirely distinct from the circuit, but all the composing machines are included in and form part of it; the circuit commences in the galvanic battery of one station, passes along the conductor to another station, through the coil of the axial magnet to an insulated iron frame of the composing machine, thence to a circuit wheel revolving in this frame; it then enters a spring that rubs on the edge of this circuit wheel, and has a connexion with the return wire, along which the electricity goes through another battery back to the station from whence it started, to pursue the same course through the composing machine and magnet there, and all others upon the line; thus the circuit is confined to the composing machines, axial magnets, conducting wires, and batteries.

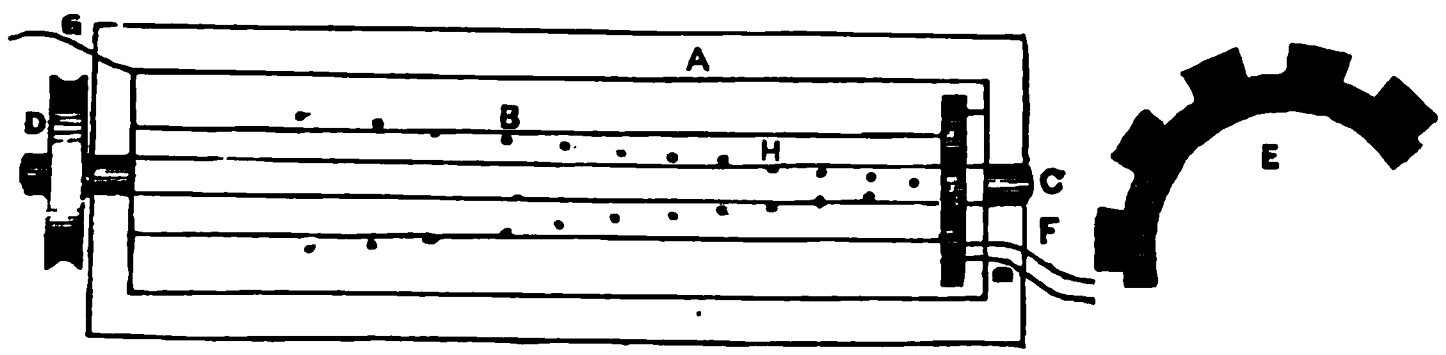
Fig. 47.



The composing machine Fig. 47, is arranged within a mahogany frame H, three feet in length, two in width, and six or ten inches deep; the various parts of the printing machine are seen on the top of the same case; both are propelled by the same manual power, which is distinct from the electric current; it is simply a crank with a pulley carrying a band to drive the machine, and a balance wheel to give stable motion; one of the spokes of the balance wheel has fixed to it, an axis for the end of a vertical shaft to revolve on, that moves the piston of an air condenser G, fastened *to the floor;* the air is compressed in the chamber I, fourteen inches long,

and six in diameter, lying beneath the mahogany case H; it is furnished with a safety-valve, to permit the escape of redundant air not needed in the economy of the machine.

Fig. 48.



The composing system has an insulated iron frame A, Fig. 48, placed immediately below the keys, parallel with the long diameter of the case; this has within it a revolving shaft C; the shaft is enclosed for the greater part of its length by the iron or brass cylinder B; it is made to revolve by a band playing over the pulley D, fixed to the left extremity of it. The cylinder is detached from the shaft, but made to revolve with it by a friction contrivance, consisting of a spiral spring arising from the shaft and pressing against the interior of the cylinder; the spring runs the whole length of the shaft: Fig. 49, shows a transverse section of it; the object of this is to allow the shaft to revolve, while the cylinder can be arrested.

Fig. 49.

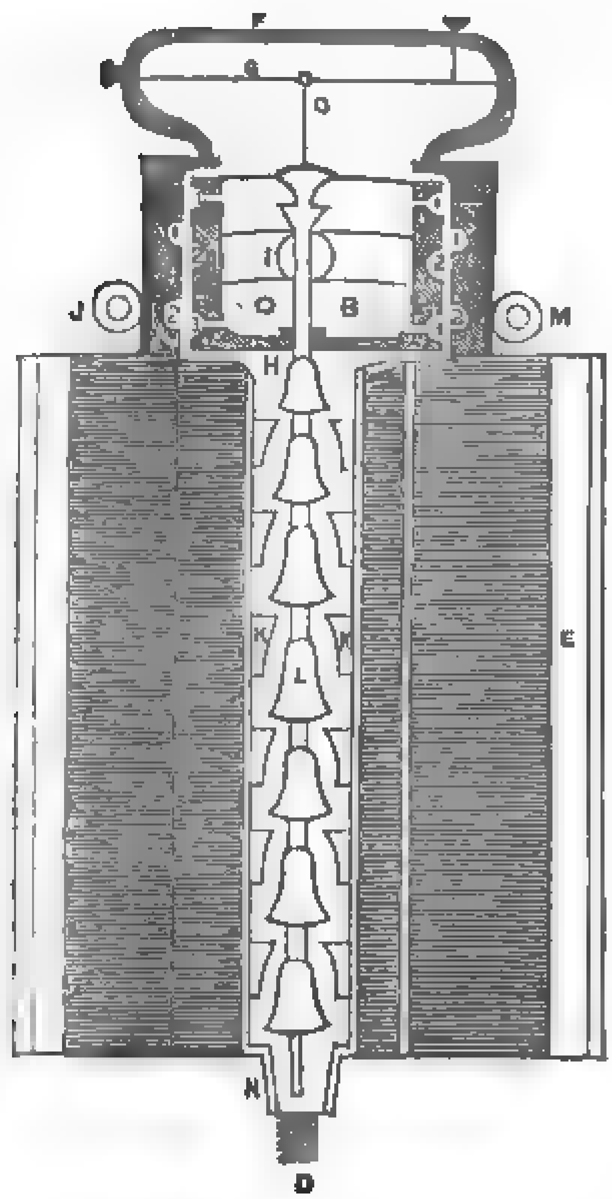
On the right end of the cylinder, is fixed the brass wheel E, Fig. 48, four or five inches in diameter, called the circuit wheel, or break; the outer edge of it is divided into 28 equal spaces, each alternate space being cut away to the depth of one-fourth of an inch, leaving fourteen teeth or segments, and fourteen spaces, Fig. 48, E; the revolving shaft and cylinder form part of the electric circuit; one point of connexion being where the shaft rests on the frame, the other through a spring F, having connexion with the other end of the circuit, pressing on the periphery of the break-wheel E; G, the other part of the circuit coming from the axial magnet to the frame A; if the shaft, cylinder, and circuit wheel revolve, the spring will alternately strike a tooth and pass into an open space; in the former case, he circuit is closed, in the latter it is broken.

For the purpose of arresting the motion of the circuit wheel and cylinder, he latter has two spiral lines of teeth H, fig. 48, extending along its oppoite sides, having fourteen in each line, making 28, one for each tooth, and ne for each space on the circuit wheel; the cylinder extends the whole ridth of the key board above it; the latter is like that of a piano-forte, ontaining twenty-eight keys that correspond with the twenty-eight proections on the cylinder, and have marked on them in order, the alphabet, dot, and dash, Fig. 47; they are kept in a horizontal position by springs; here is a cam or stop fixed to the under surface of each key directly over one f the projections on the cylinder; these stops do not meet the teeth unless e key is pressed down, which being done, the motion of the cylinder stopped by their contact; by making the circuit wheel revolve, the ircuit is rapidly broken and closed, which continues until a key is deressed; that key being released, the revolution continues until the depresion of another key, and so on; the depression of a key either keeps the

circuit broken or closed, as it may happen to be at the time, so that the operator does not break and close the circuit, but merely keeps it stationary for a moment; from one to twenty-eight openings and closings of the circuit take place between the depression of two different keys, or the repetition of the depression of the same one; the object of the composing machine is to rapidly break and close the circuit as many times as there are spaces from any given letter to the next one which it is desired to transmit, counting in alphabetical order.

The rapid electrical pulsations are transmitted by the circuit of conductors to the magnet and printing machine at another station, through the wire J, fig. 47. The helix of this magnet is an intensity coil contained in the steel cylinder A, fig. 47, on the upper surface of the mahogany case; its axis is vertical.

Fig. 50.

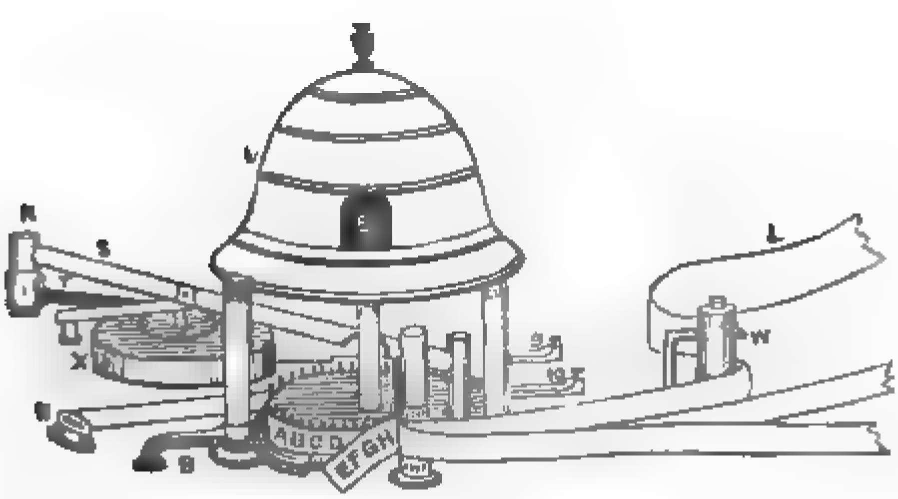


A, fig. 50, is a brass tube, eight or ten inches long, placed within the helix, and fastened at the bottom by the screw D. To the inner surface of this tube are soldered six or eight soft iron tubes, separated from each other at regular intervals. Above the steel cylinder is an elliptical ring, F, through the axis of which is extended an elastic wire, G; two screws are attached to the wire, by which it is made lax or tense, to suit the intensity of the electric current. From this is suspended the brass rod, C, that passes down within the small iron tubes before mentioned, and has strung on it six or eight small iron tubes, L; these are fastened at equal intervals and have their lower extremity expanded into a bell-like flanch; the surrounding fixed ones have their upper ends enlarged inwardly in the same manner. The tubes, L, and the wire to which they are fastened, are movable, so as to come in contact with the small exterior iron tubes K, fig. 50, but are kept separate by the elastic spring above. At E is the brass covering. On the transmission of an electric current through the helix, the tubes become magnetic. Such is the arrangement of their polarities, that they act by attraction and repulsion, overcome the elasticity of the spring, and bring the movable magnets down to the fixed ones;—the current being broken, the spring separates them. The two flanches do not come in direct contact, though the movable one acts responsive to magnetic influence. Most of the magnetism exists at the

franches, and the order is such that the lower end of the inner tube has south polarity, the surrounding one above, the same, which repels it, while the top of the surrounding one below has north polarity, and attracts it;—this movement is through a space of only one-sixty-fourth part of an inch.

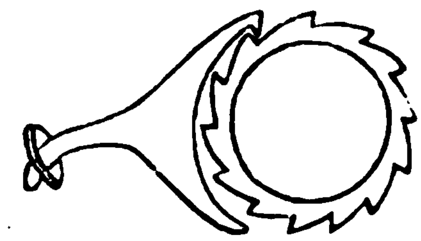
On the same rod, above the movable magnets, is fixed a hollow cylindrical valve, having on its outer circumference the grooves 1, 2, 3, fig. 50. The plate represents a longitudinal half-section of the valve, magnets, and helix. The valve slides in an air chamber, H, which has two grooves, 1, 2, on its inner surface. Air is admitted through the orifice I, by means of a pipe from the air chamber beneath the case, into the middle groove of the valve. The grooves of the chamber open into the side passages J and M, which connect at right angles with a second chamber, in which a piston moves. The movement of the magnets changes the apposition of the grooves in the first chamber, by which air enters from the supply pipe, through one of the side passages, into the second chamber, at the same time that air on the other side of the piston in the second chamber escapes back into the grooves 1 and 2 of the valve, through the other side passage, and from them into the atmosphere. This causes the piston to slide backward and forward with every upward and downward motion of the valve.

Fig. 51.



This piston moves horizontally, and is connected with the lever, 8, Fig. 51, of an escapement, the pallets of which alternately rest on the teeth of an escapement wheel of the printing machine A, Fig. 51. This part of the apparatus is arranged on a circular steel plate, twelve or fourteen inches in diameter, supported by standards on the mahogany frame, H, Fig. 47. The escapement wheel revolves on a vertical shaft that passes through the steel plate, and has fixed on it there a hollow pulley. This pulley contains within it a friction apparatus, precisely similar to that in the cylinder of the composing machine, and is driven by a band running around another pulley, (M, fig. 47.) The pulley can be made to revolve constantly, while the shaft and escapement wheel may be stopped. The escapement wheel has fourteen teeth, each one of which causes two motions of the escapement, which will make twenty-eight for a single revolution of the wheel, which is shown in fig. 52.

Fig. 52.



When in operation, the piston to which the escapement arm 8, fig. 51, is attached, is subjected, on one side or the other, to a pressure of condensed air; therefore the piston and escapement will only be moved by the escapement wheel when the air is removed from one side or the other of the piston. The position of the valve, fig. 50, attached to the magnet regulates the pressure of air on either side of the piston, by opening one or the other of the side passages into the second chamber. By breaking and closing the circuit, therefore, the piston and escapement move backward and forward; thus a single revolution of the circuit wheel at one station opens and closes the circuit twenty-eight times, causing an equal number of movements of the magnets in another station; they carry the valve which alternately changes the air on either side of the piston. This permits the escapement wheel to move the escapement and piston twenty-eight times, and allows one revolution of the escapement wheel for one of the circuit wheel at the transmitting station.

A steel type wheel, fig. 51, A, B, C, D, two inches in diameter, is fixed above, and revolves on the same shaft with the escapement wheel; it has on its circumference twenty-eight equi-distant projections, on which are engraved in order the alphabet, a dot, and a dash. The fourteen notches of the escapement wheel cause twenty-eight vibrations of the escapement in a revolution, that correspond to the characters on the type wheel. Every vibration of the escapement, therefore, makes the type wheel advance one letter; these letters correspond to those on the keys of the composing machine. If any desired letter on the type wheel is placed in a certain position, and a corresponding key in the composing machine is depressed, by raising that key, and again depressing it, the circuit wheel at one station, and the escapement and type wheel at the other station, all make a single revolution, which brings that letter to its former position. Any other letter is brought to this position by pressing down its key in the composing machine, the circuit being broken and closed as many times as there are letters from the last one taken to the letter desired.

To form the letters into words, it is necessary that the printing and composing machines should correspond, and for this purpose a small break and thumb screw, 9. 10, fig. 51, can be made to stop the type wheel at any letter. In sending messages, they usually commence at the dot; if, by accident, the type wheel ceases to coincide with the distant composing machine, the printing becomes confused, the operator stops the type wheel, sets it at the dash, and the printing goes on as before.

Above the type wheel, on the same shaft, is the letter wheel, E, fig. 51, on the circumference of which the letters are painted in the same order with those on the type wheel below. It is encased in a steel hood, having an aperture in it directly over where the letters are printed, so that when the type wheel stops to print a letter, the same letter is made stationary for a moment at the aperture, and is readily distinguished; hence messages can be read, thus making it a visual telegraph.

The type wheel has twenty-eight teeth arranged on the outer edge of its upper surface; near it, on the opposite side from where the printing is done, is the shaft T, fig. 51, revolving in an opposite direction. A steel cap,

. 51, two inches in diameter, is so attached to the top of this shaft that n carries it along with it, but it can be moved in the opposite direction; a small steel arm, three-fourths of an inch long, projecting from its ind playing against the teeth on the type wheel; while the latter is 'ing, its teeth strike this arm, and give the cap a contrary motion to ift. There is a pulley on this shaft, below the plate, connected by 1 to M, fig. 47; its speed is less than that of the type wheel. When pe wheel comes to rest, the arm falls between the teeth, but it has ne to do so when they are in motion. On the opposite side of the where the arm is attached are two raised edges, called detent pins, st which the detent arm, U, fig. 51, alternately rests, as the position cap is altered by the small arm that plays on the teeth of the type

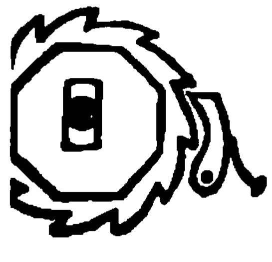
ween the type wheel and cap, is a small lever and thumb screw, 9; l, which acts as a break on the cap; its motion can be stopped by it, the type wheel revolves; it is used merely to arrest the printing, h the message may be read from the letter wheel.

e detent arm revolves in a horizontal direction about the vertical which is also driven by a pulley beneath the steel plate; when pe wheel is at rest, the detent arm rests on one of the detent pins, hen it moves, the teeth on its upper surface give the arm and cap a re- direction to its shaft, which alters the position of the detent points, so ie detent arm is liberated from this first pin, and falls upon the second, : it remains until the escapement and type wheels again come to rest; this happens, the arm falls between two of the teeth, the cap resumes t position, the detent is let loose, makes a revolution, and stops again e first pin.

e shaft that carries the detent arm has an eccentric wheel R, fig. 51, above the arm; an eccentric wheel is one that has its axis of motion · one side than the other, and while revolving, operates like a crank; this eccentric is a connecting rod S, which draws a toothed wheel st the type; this toothed wheel is supported in an elastic steel arm, out of view by the coloring band,) on the opposite side of the wheel from that of the eccentric, and revolves in a vertical direction; ind E, fig. 47, carrying the coloring matter to print with, passes be- . this and the type; the dots seen represent small teeth that catch the and draw it along, as the wheel revolves, between itself and a steel operated by a spring that presses the paper againt the teeth and keeps oth; the clasp is perforated in such a manner that the type print gh it; there are two rows of teeth, one above, the other below the

e vertical wheel, fig. 51, is embraced in a ring by the connecting shaft l a rotary motion is imparted to it by a ratchet fixed to its lower e, moving with it and catching against two poles fastened to the steel below it; the poles are pressed against the ratchet by springs as shown in fig. 53; the wheel is octagonal, and every revolution of the eccentric, turns it through one-eighth of a revolution, and therefore presents a firm, flat surface to push the paper against the type, and advances sufficient for every letter, one being printed each time *the detent arm revolves.*

Fig. 53.



When the type wheel stops, the detent arm revolves, that carries with it the eccentric, which through the connecting rod draws the toothed wheel having the paper and coloring band before it against the type, and an impression is made on the paper; a letter is printed if the circuit remains broken or closed longer than one-tenth of a second; about one hundred and sixty letters in the form of Roman Capitals, can be accurately printed per minute; the roll of paper L, fig. 51, is supported on a loose revolving wire frame work; on the same standard is a small pulley W, around which one end of the coloring band runs.

In transmitting a message, the machine is set in motion, a signal is given, (which is simply the movement of the magnet,) and then with the communication before him, the operator commences to play like a pianist on his key board, touching in rapid succession, those keys which are marked with the consecutive letters of the information to be transmitted; on hearing the signal, the operator at the receiving station tells his assistant to turn the crank, setting the machine in motion; then setting his type at the dash, sends back signal that he is ready, and the communication is transmitted; he can leave his machine, and it will print in his absence; when the printing is finished, he tears off the strip which contains it, folds it in an envelope ready to send to any place desired. The Governor's Message has been transmitted by this instrument, and published entire in New York, two hours after its delivery in Albany.

The function of the electric current in this machine, together with the condensed air, is to preserve equal time in the printing and composing machine, that the letters in one may correspond with the other; the electrical pulsations determine the number of spaces or letters which the type wheel is permitted to advance: they must be at least twenty-five per second to prevent the printing machine from acting; the intervals of time the electric currents are allowed to flow unbroken are equal, and the number of magnetic pulsations necessary to indicate a different succession of letters are exceedingly unequal; from A to B, will require one-twenty-eighth of a revolution of the type wheel, and one magnetic pulsation; from A to A, will require an entire revolution of the type wheel and twenty-eight magnetic pulsations.

The first line operating with this instrument was completed in August, 1850, by the Boston and New York Telegraph Company, between those cities, passing through Providence, Norwich, Hartford, and New Haven; they were incorporated with a capital stock of $27,000 by the Legislature of Massachusetts, April 20, 1849; it has also been patented in England, by Jacob Brett, who is extending the lines through that Kingdom.

In reply to an inquiry of mine in regard to the number of lines employing this form of telegraph, I received the following dispatch:—

"The Boston and New York Telegraph Company using House's Printing Telegraph; about six hundred miles of wire; two wires. Stations at Boston, Mass., Providence, R. I., Springfield, Mass., Hartford, Conn., New Haven, Conn., and New York. A line being constructed to connect with the Boston line, running from Springfield, Mass., to Albany, N. York, there intersect the New York and Buffalo line, using the same *instruments*, extending from New York to Buffalo, a distance of five hun*dred and seventy* miles. One wire now in operation, connecting with

Poughkeepsie, Troy, Albany, Utica, Syracuse, Lyons, Rochester, Albion, Lockport, and Buffalo; and another wire nearly completed, same distance. The same line to continue to St. Louis, Mo., connecting with Cleveland, Cincinnati, Louisville, and St. Louis; will be completed the entire distance by January, 1852, forming the longest line in the world under the direction of one company; whole length being fifteen hundred miles. The New Jersey Magnetic Telegraph Company, using House's instruments, and the first line ever put in operation, extends from Philadelphia to New York; one wire, CXXXII miles; another now being put up.

Respectfully, J. W. PHILIPS."

Subjoined is a specimen of the form of printing executed by this machine, kindly offered by the principal operator at this station, Mr. J. W. Philips, to whom, and the records of the House trial, I am indebted for most of my information.

HOUSES-PRINTING-TELEGRAPH

To be Continued.

Hints on the Principles which should regulate the Forms of Boats and Ships; derived from original Experiments. By Mr. William Bland, *of Sittingbourne, Kent.**

Continued from page 117.

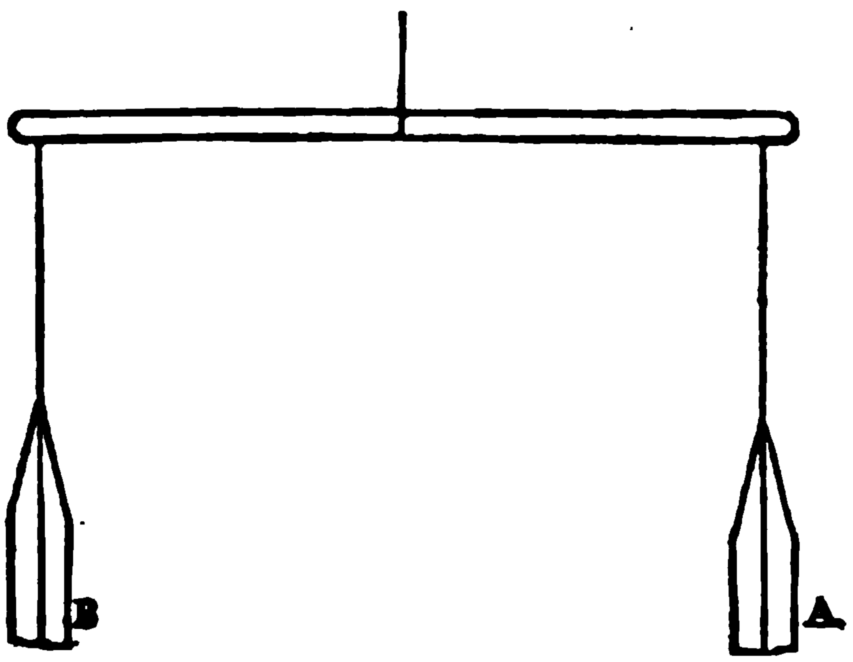
Chapter V.

The whole body of a ship comes next into consideration; and with the view of investigating the same in a perfect and lucid manner, it will be advisable to divide the subject into three parts—as "the Bows," "the Stem," and "the Middle."

Of the Form of the Bows.

The experiments which were put into practice for ascertaining the law relative to the difference of form when exposed to the action of water, are arranged severally as follows. And the diagram beneath exhibits the mode by which the testing of the speed was applied.

The Balance Rod. Scale one-sixteenth.



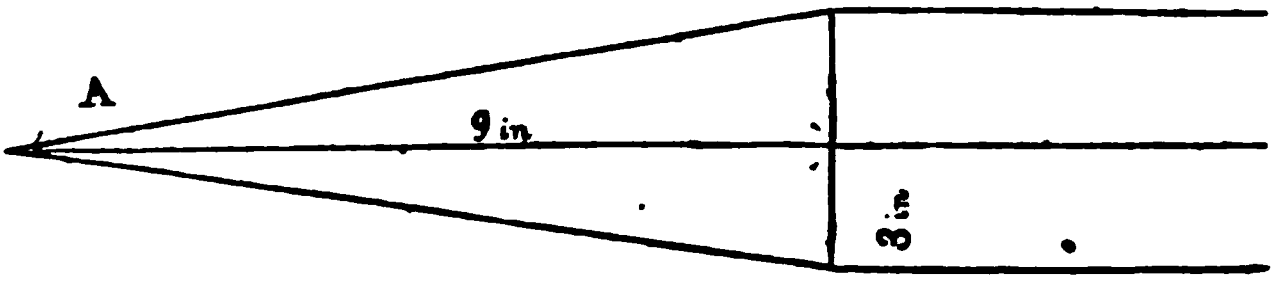
Experiment 9.

First. The form of the model selected was that of an isosceles triangle,

* From the London Architect for September, 1851.

having the perpendicular distance of the base from the apex three times the width of the base.

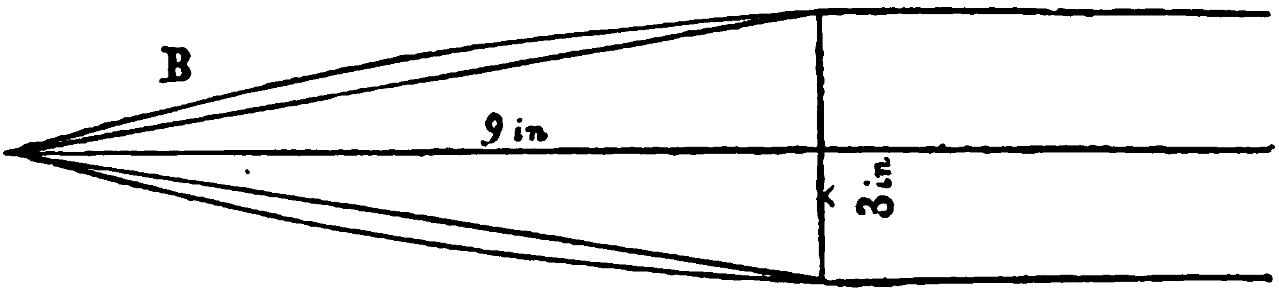
Weight 12 oz. Thickness 1½ inch.



Experiment 10.

Second. This form was an isosceles spherical triangle, of the same perpendicular length and width at the base as the preceding, but having the two sides uniting the base with the apex convex; the curve subtending at the middle of the length one-quarter of an inch beyond the straight lines uniting these two points.

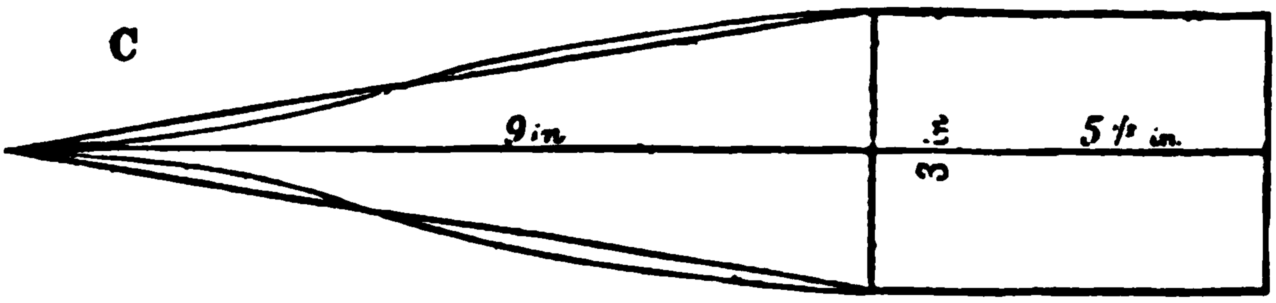
Weight and Thickness as A.



Experiment 11.

Third. The form of an isosceles triangle, with its two sides waved; and the dimensions in other respects the same as models A and B.

Weight and Thickness as B.



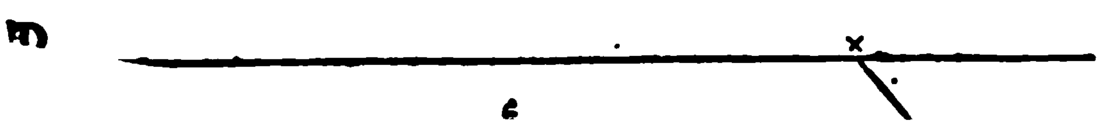
These three models of deal, A, B, C, of the same precise weight, dept' width, and length, were tested on the water against each other, by t' balance-rod, and the following results were obtained:

Model B had the greatest speed,
Model A the next,
Model C the least.

But the difference between them was trifling.

Experiment 12.

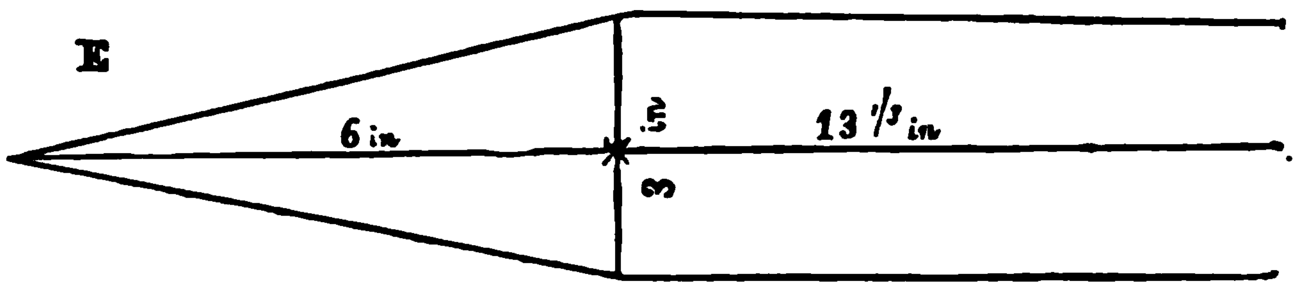
The model A was then tried against the fourth model D, of the form of bows, dimensions, and weight, but having its lower is sides beveled off.



Experiment 13.

The next test of bows was with those of less sharpness, and compared first with the sharp-modelled bow A, and then with others of less acute angles.

Weight $14\frac{3}{4}$ oz. Thickness $1\frac{1}{2}$ inch.



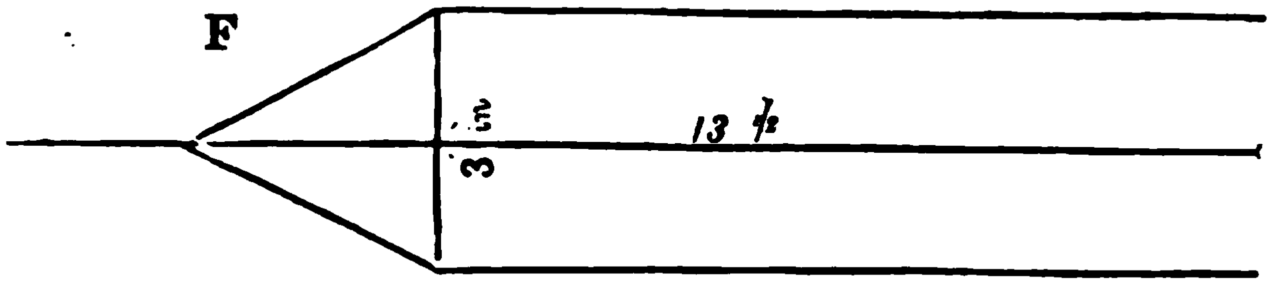
The isosceles triangle form of bows E, had its perpendicular distance from the base 6 inches; yet having the width, depth, and base precisely the same as A.

The conclusion arrived at was, that the speed of A : E : : $6\frac{1}{2}$: 5.

Experiment 14.

The speed of E was then tested with the speed of the model F, having its base and sides equilateral.

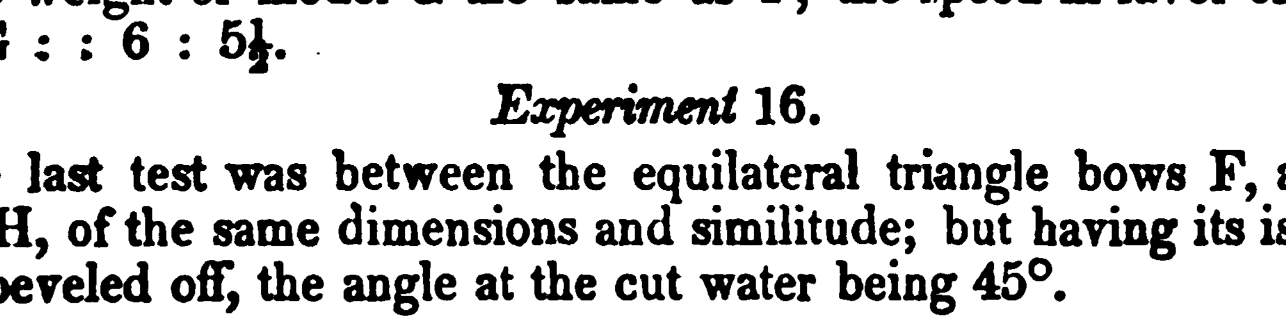
Weight and Thickness as E.



The result gave the speed in favor of E : F : : 3 : 2.

Experiment 15.

The model F was tried against G, a model having its bows a spherical equilateral triangle.

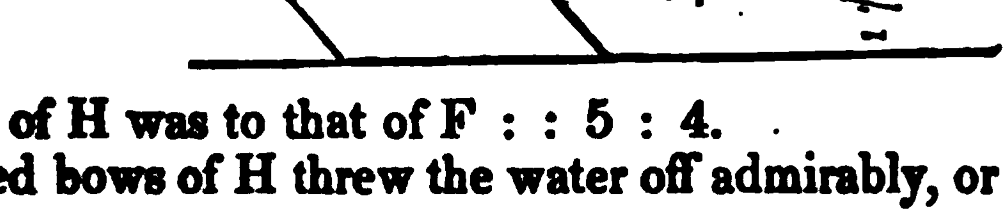


The weight of model G the same as F; the speed in favor of F was F : G : : 6 : $5\frac{1}{2}$.

Experiment 16.

The last test was between the equilateral triangle bows F, and the bows H, of the same dimensions and similitude; but having its isosceles sides beveled off, the angle at the cut water being 45°.

Weight and Thickness as F.



The speed of H was to that of F : : 5 : 4.

The beveled bows of H threw the water off admirably, or rather it may

be said to ride over it, and was always dry during the experiment; whereas F shipped water continually over the bows with the least extra speed.

The conclusions obtained by the experiments in this chapter are, that the more sharp the forms of the bows the less is the resistance from water; and when a gentle curve is given to the bows, the speed is rather improved. Again, by the beveling of short bows, the speed becomes greatly improved; but this is not so apparent in the long and sharp bows. The beveled short bows rode over the water as it were, or at least was in a degree lifted up by it, and therefore did not throw the water up like the perpendicular side bows.

(To be Continued.)

---

*Export of Metals from the United Kingdom.**

The Board of Trade returns afford the following detailed account of the quantities of metal of home produce and manufacture exported from the United Kingdom during the month ending the 10th of October last as compared with the corresponding period of the two previous years:

Metals.		1849.	1850.	1851.
Iron—Pig,	tons	20,309	11,333	18,068
Bar, bolt, and rod,		38,451	44,438	47,094
Wire,		478	457	505
Cast,		1,580	1,812	1,398
Wrought of all sorts,		11,688	14,534	13,680
Steel—Unwrought,		801	1,171	1,334
Copper, in bricks and pigs,	cwts.	19,909	24,189	8,854
Sheets, nails, &c. (including mixed or yellow metal for sheathing,)		26,112	30,373	18,792
Wrought of other sorts,		1,027	491	1,495
Brass of all sorts,		2,593	3,553	2,625
Lead,	tons	2,739	2,345	2,213
Tin—Unwrought,	cwts.	5,315	4,392	2,514
Tin-plates,	value	£78,177	£88,254	£71,386

These returns show that the increased movement in the metal trade, noticed for so long a period, has this month received a rather sensible check. The total value of all the metals comprised in the above table is 797,812*l.* this year, against 893,780*l.* in the corresponding period of 1850, and 830,310*l.* in 1849. There is thus a decrease of 95,968*l.* on 1850, and of 32,498*l.* on 1849. On referring to the various items, w find the falling off to extend to copper, lead, tin, and tin-plates, but it most evident in the first named article, the exports of copper and br being only 137,808*l.*, against 243,218*l.* last year, and 210,626*l.* in 18 Iron, on the other hand, has largely increased, the aggregate figu being 493,705*l.* this year, against 464,018*l.* and 446,213*l.* in the s month of the two previous years. Steel has also increased; the return the nine months ending with the same date, give the total exports as lows:—1851, 7,189,107*l.*; 1850, 6,869,076*l.*; 1849, 6,216,420*l.*; so the aggregate trade of the year, so far as yet ascertained, shows a crease of 320,031*l.*, or 4½ per cent. over the same period of 1850 an increase of 972,687*l.*, or 15 per cent. over the year before. The f trade in iron is proved to be steadily extending, as the demand for f

*From the London Mining Journal, No. 847.

railways is more sensibly felt. The iron and steel exports are 4,393,070*l*. in 1851, against 4,020,355*l*. in 1850, and 3,667,348*l*. in 1849. Copper figures for only 1,291,407*l*. against 1,429,773*l*. in 1850, and 1,414,377*l*. in the year previous. In the year's returns of tin-plates and lead there is a considerable increase, so that the falling off of the month is only a trifling reaction, but the decrease in tin is continuous. The exports of foreign and colonial produce for the month ending October 10th, are as follows:

		1849.	1850.	1851.
Copper, unwrought and part wrought,	cwts.	1045	3151	1483
Iron, in bars, unwrought,	tons	571	758	1174
Steel, unwrought,		9	23	168
Lead, pig and sheet,		742	194	298
Spelter,		424	126	205
Tin, in blocks, ingots, bars, or slabs,	cwts.	808	849	1460
Quicksilver,	lbs.	116,527	29,419	67,332

On the nine months we have a great increase in copper, which stands at 22,569 cwts., against 12,428 last year, and 12,447 in 1849. Taking this result in connexion with the diminished export of our home produce, it is evident that the foreign and colonial supplies of this metal are daily becoming of more importance, the working of the copper mines of Australia producing a sensible effect. Iron has slightly fallen off, whilst steel and tin remain at the reduced range of last year, though this last item is recovering. Spelter is steadily decreasing, the figures being only 1509 tons, against 3110 tons last year, and 3632 in 1849. The returns of imports for the month ending October 10, are:

Metals.		1849.	1850.	1851.
Copper ore and regulus,	tons	5627	4174	1805
Copper, unwrought, and part wrought,	cwts.	1015	2807	5360
Iron, in bars, unwrought,	tons	4739	5068	7146
Steel, unwrought,		102		39
Lead, pig and sheet,		1109	695	1356
Spelter,		2371	2269	1468
Tin, in blocks, ingots, bars, or slabs,	cwts.	3967	539	5704
Quicksilver,	lbs.	100,469		

In this instance also, taking the nine months' returns as the basis of comparison, there is exhibited a continuous falling off in the various descriptions of copper, and an increase in iron and steel. Lead and tin have also largely augmented, showing the increased consumption of the country. Spelter has risen to 16,204 tons, against 11,429 last year, and 8722 in 1849; and as the exports of this article are as gradually diminishing, it would appear that the free admission of this metal is bringing it into much more extensive use.

For the Journal of the Franklin Institute.

Boilers of the U. S. Steamship Fulton. By Chief Engineer, B. F. Isherwood, *U. S. Navy.*

Since writing an account of the performance of the *Fulton*, on her trial trip, I have been able to ascertain the performance of her boilers under the ordinary circumstances of sea steaming, burning the fuel with natural draft, and without forcing the fires.

The fuel used was soft anthracite, a mean between the Cumberl coal and the anthracite proper. The data is the average of 11 hours co tinuous steaming.

BOILERS.—PLATE I.

Two double return drop flue iron boilers, circular from end to en placed side by side.

Length of each boiler, ...	22 feet.
Diameter, ...	10 feet 6 in.
Contents of circumscribing parallelopipedon of each boiler, exclusive of steam chimney, ...	2425·50 cu. ft.
Area of heating surface in the two boilers, . . .	2600·00 sq. ft.
" grate " " . . .	112·00 "
Cross area of upper and middle row of flues, each, in the 2 boilers,	16·75 "
" lower row of flues, in the two boilers, . .	17·40 "
" chimney, ...	21·65 "
Height of chimney above grate, ...	43·00 feet.
Pressure of steam above atmosphere in boiler per square inch,	24·00 lbs.
Initial steam pressure above atmosphere in cylinder, " .	22·30 lbs.
Cutting off at, from commencement of stroke, . .	3·00 feet.
Number of double strokes of piston per minute, . .	16.
Consumption of anthracite coal per hour with natural draft,	1342·00 lbs.
Capacity of steam room in boiler and steam pipe, .	1210·00 cu. ft.

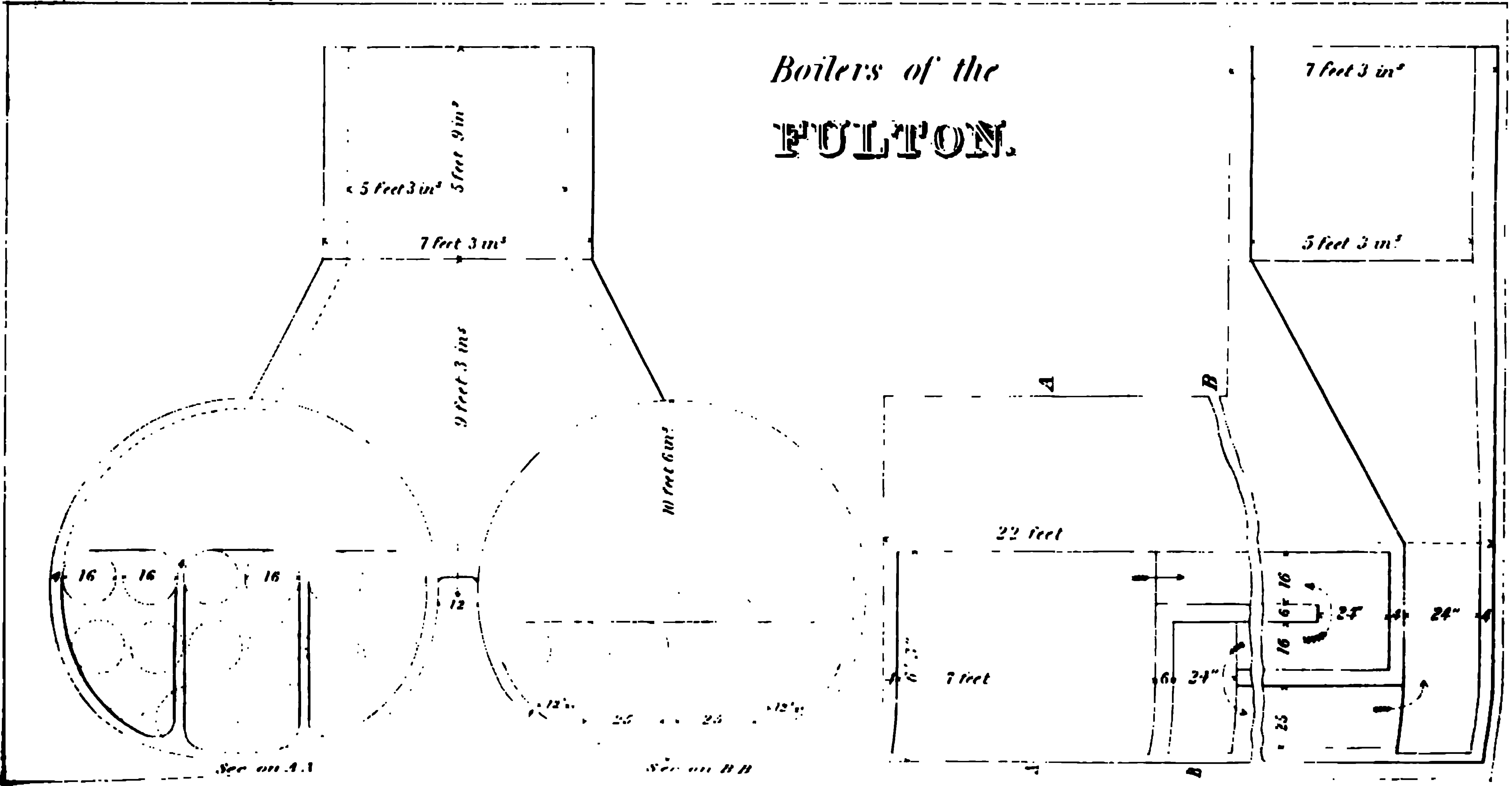
PROPORTIONS.

Proportion of heating to grate surface, . .	23·214	to 1·000
" grate surface to cross area of upper and middle row of flues, each, . .	6.687	"
" " lower row of flues, . .	6.437	"
" " chimney, . .	5·173	"
" heating surface to cross area of upper and middle row of flues, each, . .	155·224	"
" " lower row of flues, .	149·425	"
" " chimney, . . .	120·092	"
" " per cubic foot of space disp. of piston,	18·453	sq. feet.
" " " per double stroke of pist. per min.	1·153	"
" grate, "	0·050	"
" " " per cu. ft. of space disp. of piston,	0·795	"
Cubic feet of steam room per cubic foot of space displacement of piston, ...	8·587	
Consumption of anthracite coal with natural draft per square foot of grate surface per hour, . .	12·000	lbs.
" heating "	0·516	"
Sea water evaporated by one pound of anthracite coal per hour,	5·552	"
" " one sq. ft. of heating surface per hour,	2·865	"

Weight of boilers, exclusive of chimney & grates,	111,356 lbs.	
" chimney, jacket, and chains, .	7,400 "	
" grates, ...	5,239 "	
		123,995 "
" sea water in boilers, . .		82,300 "
Total weight of boilers and water, . .		206,295 "

In the above calculation of the amount of sea water evaporated p pound of coal, there is nothing allowed for blowing off, as the density the water is recorded from $\frac{1}{32}$ to $\frac{1.75}{32}$ progressively. There being evap rated per hour 7112·67 pounds of sea water, there would be requir over 11 hours steaming to make the density $\frac{2}{32}$, supposing the density starting to be $\frac{1}{32}$. There has, however, been included in the calculati the quantity of steam (3·094 cubic feet) required to fill the spaces betw valves, in nozzles, and clearance of cylinder.

Boilers of the FULTON.



	Johnson's Boiler.	Fulton's Boiler.
rtion of heating to grate surface,	26·000 to 1·000	23,214 to 1·000
grate surface to least calorimeter,	6·449 "	6·687 "
t of chimney above grate, .	58·000 feet.	43·000 feet.
ls of anthracite coal burned per sq. foot rate per hour with natural draft,	6·430.	12·000.
ls of fresh water evaporated per hour pound of anthracite, from a temperature 00° F. . .	8·900.	5·713.
ls of fresh water evaporated per hour square foot of heating surface, from a perature of 100° F. . .	2·060.	2·960.

ove figures show pretty conclusively the advantages to be de- m a slow combustion, in giving time not only for the atmospheric come so well mixed with the constituents of the fuel as to com- xidize them, but also in giving time for the caloric to enter the be taken up by it.

above two boilers, we find that with nearly equal proportions of o grate surface, nearly double the quantity of fuel is burned per ot of grate per hour in the Fulton's boiler, while the quantity of aporated per square foot of heating surface per hour is only 43·7 *more;* while the economical evaporation is 35·8 *less.* Now, inas- in one case there is burned double the quantity of fuel per unit er unit of time, than in the other, it is obvious that if the two ons were equally complete, double the amount of caloric would ed in the one case over the other, and if it were proportionally by the heating surface, double the quantity of water per unit of urface per unit of time would be evaporated in the one case over ; but we find this difference to be practically only 43·7 per cent. nsequently the caloric, if evolved, could not have been taken up

It is not, however, always practicable in a steamship to obtain space for a larger boiler, and economy of fuel must frequently be sacrificed to other considerations. The economical evaporation of the Fulton's boilers is about equal to that of the general average of marine boilers.

In making the comparison *absolutely*, it must be borne in mind, that in the Fulton's boilers there were wastes by leakage of steam through the valves, and by foaming, *not included* in the calculation of their evaporation, while the calculation of the evaporation in Johnson's boilers was made from measurement of the actual amount of water put in them; of course, the calculation was *inclusive* of all losses.

For the Journal of the Franklin Institute.

Reply to the Remarks of J. V. Merrick, Esq., on Screw Propellers. By J. W. Nystrom.

The critique of Mr. J. V. Merrick, in the January number of the Journal, was not seen by me until some time in February. With the greatest respect for Mr. M., it is the principles set forth in his article, and the defence of a theory *not unsupported* by proof and probability, that has called forth the present article.

First, as to the slip of the San Jacinto; I will not contradict the assertions made by reliable witnesses, as I was not there.

Mr. Merrick suggests, first, "a heavy weather at sea, &c." We could as well say a good fair wind, which then would decrease the slip; these are results of circumstances. The assertion that there would be "no difficulty in giving the propeller 50 revolutions," was misunderstood. If the readers of the Journal will examine my statements and formula 11, page 330, last vol., they will see it never entered my thoughts to say *a paddle wheel which makes* 31 *revolutions can, with no difficulty, make* 50. But when the power of the steam engine, and the diameter, pitch, and *slip* of the propeller are given, *from them*, I said there would be no difficulty in giving the propeller 50 revolutions per minute, and the words, "the number of revolutions can *not* be increased ad libitum," prove that my statements were misunderstood. As to the slip being a measure of loss of effect, I supposed the propeller to have no slip, in order to prove that the slip is not a measure of loss of effect; this, I see, has not been fairly understood, and will endeavor to make it plainer. If we say the slip to be determined of 100, and 0—and *in* and *between* those two points, examine the slip, we will find that when the slip is 0, there exists no "recession of the fulcrum against the propeller blades," and the propeller does not act to propel the vessel, but merely runs with it, and there exists no loss of effect. On the other hand, we suppose the slip to be 100, (that is, when the vessel stands stationary, and the propeller is running,) and the slip is a measure of loss of effect as described by Mr. Isherwood, then the slip should take away *all the effect* from the steam engine, and *not allow* any for the friction and working the pumps; still the steam engine runs.

Again, let us take a few steps back, and suppose the slip to be 80 per cent., which is often the case with tow boats; then, if the loss of effect is

80 per cent., there is only twenty per cent. left, which is nothing more than what is required for the friction and working the pumps, consequently nothing left as useful effect for towing; still the vessel is running, and in this age of common sense, we do not believe that witchcraft tows the vessel; take the same tow boat to tow a smaller vessel, which causes a slip of only 50 per cent.; the friction and working the pumps being the same, 20 per cent., then there remains 30 per cent., as useful effect for towing. We see now, that if slip is a measure of loss of effect, it requires more power to propel a small vessel, and no power to propel the largest vessel.

I am obliged to Mr. Merrick, for reminding me what slip is, but would in turn, remind him, that there is as much difference between the slip of a locomotive wheel, and slip of a propeller, as there is between the sleepers and water. I was careful to state, in the article referred to, "*slip in the water.*" The locomotive runs on sleepers; therefore, if Mr. M. will try the experiment with a locomotive in water, he will find it will run as well without the wheels.

In reminding me what slip is, Mr. Merrick says: "slip is a loss of space passed over in a given time; hence a loss of velocity; and therefore, that it is what is commonly called, "loss of effect," or more correctly speaking, loss of useful effect."

Am I so greatly mistaken? or is it necessary, in this Journal, to go back to the school boy's task, and explain the difference between *velocity* and *effect?*

Effect is the *product* of *resistance* and *velocity*. But for screw propellers, this velocity is nothing but the slip of the propeller, or more correctly, the velocity of the pitch, multiplied by the slip. If we again suppose there is no slip, the velocity of the resistance will also be nought; but when we suppose the slip to be the unity, the velocity of the resistance will be equal to the velocity of the pitch. If we say the velocity of the pitch to be =1, then the velocity of the resistance will be equal to the slip, and effect equal to the product of the slip and resistance.

When a plane moves in water, perpendicular to the direction of its motion, the *resistance* will be in proportion *nearly as the surface of the plane and square of its velocity;* therefore, effect will be equal to the cube of the velocity multiplied by the surface of the plane; and for screw propellers, the useful effect which propels the vessel, will be measured by the *cube of the slip multiplied by the area of the propeller.*

Expressed in a formula, the effect delivered from the steam engine should be

$$\text{Effect}=A\,S^3$$

which in full, reacts to propel the vessel, with the same effect; or,

$$\text{Effect}=p\,v.$$

See further for explanation of the letters.

If there exists any loss of effect by slip, I *cannot* find where it will be. From observations on propellers, we will find that propellers with more pitch and slip, employ the effect better than propellers with less pitch and slip. See the remarks of Lieut. Gordon, of the R. N., on screw propellers, page 62, last vol. I do not mean to say that slip in itself is any gain of effect, but the gain consists in this, that propellers, with more

pitch and slip, do not require a proportionate power from the steam engine, to give the propellers the same velocity, as propellers with less pitch and slip.

Although there is a limit for the proportions of pitch and diameter, which may be about the former three times the latter.

For the present, we will make a rough sketch in reference to the slip on the *San Jacinto*; the letters will denote,

p=mean thrust given by the dynamometer in pounds; see page 344 last volume.

v=velocity of the vessel in feet per second.

S=velocity of the slip in feet per second.

s=slip of the propeller in a decimal fraction.

r=resistance of the water to the propeller in pounds.

The mechanical effect executed on both sides of the propeller should be equal; then we have

$$p.\,v = r.\,S.$$

$$\text{and } r = \frac{p.\,v.}{S}$$

$$\text{but } v = 1 - s$$

$$\text{then we obtain } r = \frac{p\,(1-s)}{s} = \frac{p}{s} - p \quad . \quad . \quad . \quad (1.)$$

By reference to Haswell's Pocket Book, on page 229, it says:

"1. That the resistance is nearly as the surface, the resistance increasing but a very little above that proportion in the greater surfaces.

"2. The resistance to the same surface is nearly as the square of the velocity, but gradually increasing more and more above that proportion, as the velocity increases."

At the bottom of page 231, in the table, we find that one square foot having a velocity of 10 feet per second, will sustain a resistance of 112 pounds. From these we obtain the following analogy:

$$10^2 : 112 = A\,S^2 : r$$

$$\text{and } r = \frac{112\,A\,S^2}{100} \quad . \quad . \quad . \quad . \quad (2.)$$

If we, from these formulæ, 1 and 2, calculate the resistance, we should obtain two equal results. A=165 square feet, area of the propeller.

$$S = \frac{968 \times 26}{60 \times 74} = 5{\cdot}66 \text{ feet per second.}$$

$$p = 12{,}815 \text{ pounds.}$$

$$\text{Formula 1.} \qquad r = \frac{12815}{0{\cdot}26} - 12{,}815 = 36{,}273 \text{ pounds.}$$

$$\text{Formula 2.} \qquad r = \frac{112 \times 165 \times 5{\cdot}66^2}{100} = 5900 \text{ pounds.}$$

These two results, which should be equal, *one* is more than *six* times the other. Both of them cannot be right. If we add them together, and divide the sum by two, the mean resistance will be 21,086 pounds. Perhaps that will come nearer the proper one.

In the last volume, on page 403, the formulæ gives the slip to be nearly 38 per cent.; if we, in the same manner as above, calculate the resistance from the formulæ 1 and 2,

$$s=0{\cdot}38.$$

$$S=\frac{968\times 38}{60\times 62}=9{\cdot}9 \text{ feet per second.}$$

Formula 1. $r=\frac{12815}{0{\cdot}38}-12815=20{,}900$ pounds.

Formula 2. $r=\frac{112\times165\times9{\cdot}9^2}{100}=18{,}100$ "

Mean resistance, $=19{,}500$ "

If the slip has been a little over 39 per cent., then it has corresponded with the table in Haswell's Pocket Book, which experiments were made with a plane of only one square foot; but we doubt it will differ so much as in the first instance, with 26 per cent. slip. We leave this to propeller builders for further investigation.

For the Journal of the Franklin Institute.

Performance of the U. S. Screw Steamship San Jacinto, on an Experimental Trip from New York to Norfolk. By Chief Engineer B. F. Isherwood, *U. S. Navy.*

On the 1st January, 1852, the *San Jacinto* left the Navy Yard at Brooklyn, for Norfolk. Her draft of water was 16 feet 10 inches forward, and 17 feet 2 inches aft; mean draft 17 feet. During her passage down the Bay, there was a dead calm and slack tide, the flags at Fort Hamilton drooping from their staves. By observations taken on board the U. S. Steamer *Fulton*, the *San Jacinto* was precisely two hours in going from the Navy Yard to the South West Spit; distance per Coast Survey, 18½ miles, or 9¼ statute miles per hour. By observation on board the ship, however, and by log, she went this distance at the rate of 8 knots of 6140 feet (made that length in this particular case) per hour, or 9·3 statute miles. I shall take the latter speed as most probably correct, being obtained by observation on board; the discrepancy is, however, very small, amounting to only ·05 of a statute mile per hour. The reports of speed were made from the different vessels without communication. The number of revolutions of the screw per minute was 25¼; steam pressure in boiler per square inch above atmosphere, 10 pounds, cut off at half stroke; vacuum in condenser, 24 inches of mercury; throttle three-fourths open; the engines working irregularly, passing one centre very slowly. *Slip of the screw,* 23·71 *per cent.*

After passing outside of Sandy Hook, the mean of four hours steaming was as follows, viz: Speed of vessel, 7 knots per hour; revolutions of the screw per minute, 22¼; steam pressure in boiler above atmosphere, per square inch, 10 pounds; cut off at half stroke; vacuum in condenser,

24¾ inches of mercury; throttle three-fourths open; *very* light head wind, and sea perfectly smooth. *Slip of the screw*, 24·25 *per cent.*

For the next four hours, in continuation, with a light favorable wind, fore and main topsails set, sea smooth, the vessel made 8½ knots per hour; revolutions of the screw, 23 per minute; steam pressure in boiler above atmosphere, per square inch, 10 pounds; cut off at half stroke; vacuum in condenser, 25 inches of mercury; throttle five-eighths open. *Slip of the screw*, 11·02 *per cent.*

The eccentric of the port engine now broke, and it was not until January 3d that the damage was repaired, and the engines got in operation. At starting again, against a very strong wind and head sea, no sail set, the speed of the vessel was 5¼ knots per hour; revolutions of the screw, 25 per minute; steam pressure in boiler, 10 pounds per square inch above atmosphere; cut off at one-half stroke; vacuum in condenser, 24 inches of mercury; throttle wide. *Slip of the screw*, 49·43 *per cent.*

Close reefed fore and main topsails being now set, produced no sensible change either in the speed of the vessel or revolutions of the screw.

The wind now (Jan. 5) increased to a very heavy gale, directly ahead, accompanied by a very heavy head sea; no sail set, and vessel pitching and rolling with great violence. Speed, (mean of 12 hours,) 3·52 knots per hour; revolutions of the screw, 22⅝ per minute; steam pressure in boiler per square inch, above atmosphere, 10 pounds; cut off at one-half stroke; vacuum in condenser, 24 inches of mercury; throttle three-fourths open. *Slip of the screw*, 62·88 *per cent.*

On January 6, with fresh gales abeam and heavy sea, close reefed fore and main topsails set, and ship rolling heavily, the vessel made 4½ knots per hour; revolutions of the screw, 19 per minute; steam pressure in boiler above atmosphere, 5 pounds per square inch; vacuum in condenser, 24 inches of mercury; throttle one-half open. *Slip of the screw*, 42·97 *per cent.*

On January 7, the piston (made of brass) of the port engine broke. This engine was then disconnected, and the vessel worked with the starboard engine alone.

On January 8, there being no wind, and the sea smooth, the vessel made with the one engine alone, 7½ knots per hour; revolutions of the screw, 23 per minute; steam pressure in boiler per square inch, 11 pounds; cut off at one-half stroke; vacuum in condenser, 25 inches of mercury; throttle three-fourths open. *Slip of screw*, 21·48 *per cent.*

The performance of the vessel in heavy weather, "laying to," was as follows, viz: In a heavy head sea, and heavy gales and squalls ahead, with the engines stopped and screw dragging, vessel pitching and rolling violently, close reefed fore and main topsail set, and fore storm staysail; speed, 2½ knots per hour. Under these circumstances, it was difficult to tack or wear the ship, the latter operation requiring 30 minutes. The best sailing ship of her size, under these circumstances of weather, speed, and sail, could have done no better.

With moderate breezes and heavy sea, the vessel made with the above sail, 5½ knots per hour; engines stopped; screw uncoupled, and revolving by its friction on the water.

On arriving at Norfolk, January 8, the vessel's draft was 16 feet forward,

nd 16 feet 1 inch aft; mean, 16 feet ½ inch, or 11½ inches less than at starting.

By referring to the previous account of the trial trip of the *San Jacinto*, it will be found that the slip is given on that occasion at 26·27 per cent., with the vessel at the mean draft of 15 feet 8 inches; while on the present passage down New York Bay, the slip was 23·71 per cent., with a mean draft of 17 feet. The stern drafts in the two cases were 15 feet 9 inches, and 17 feet 10 inches, or there was a difference of 2 feet 1 inch in the depth of water on which the screw acted. In the report on the trial trip, it was thought the speed of the vessel a little underrated, and that the effect of the "strong wind on the port bow" operated a greater reduction than one mile per hour." The reporters preferred to err a little on the safe side, rather than risk error in giving the vessel too much speed. At the close of the present trip to Norfolk, the slip was 21·48 per cent., with a mean draft of vessel of 16 feet ½ inch. Taking the mean of the three slips, we have a slip of 23·8 per cent. It will be observed that the Board which fixed the proportions of the screw of the *San Jacinto*, estimated its slip at 22 per cent., a much nearer calculation than that of Mr. Nystrom, who makes the slip 37·7 per cent., and undertakes, in a late number of the *Journal*, to correct their observations of the speed of the vessel, and revolutions of the screw, which determine the slip, by some empirical formulæ invented by himself. Now an empirical formula of any kind will only give correct results so long as *all* the conditions, intrinsic and accidental, of the case on which it was founded, exist *exactly the same* in the case to which it is applied; and it is rather difficult to conceive how formulæ founded on the performance of a few Philadelphia little tug steamers, fitted with Loper's propellers, could apply to a steamship of the size and fine model of the *San Jacinto*, propelled with a screw of the most effective form.

The small slip of the screw of the *San Jacinto*, comparatively to its surface and the resistance of the vessel, is the best illustration of the advantage of a rapidly increasing pitch.

---

*Commercial Statistics of Great Britain.**

The information collected by Mr. Braithwaite Poole for his valuable work, certainly exhibits most surprising results. Pitt and Canning stated the yearly production of our agricultural and manufacturing pursuits at an amount equal to the national debt; but nobody knew how they made it out. The summary of these statistics, however, prove that our great statesmen were right; and the comparisons are highly interesting.

Mr. Poole shows that the Railways have cost 240,000,000*l.*; the Canals, 26,000,000*l.*; and the Docks, 30,000,000*l.*

Our Mercantile Marine consists of 35,000 vessels, 4,300,000 tons, with 240,000 men; and one vessel is lost on an average every tide.

Our Navy consists of 585 vessels, 570,000 tons, and 48,000 men. Yachts 520, and 23,000 tons.

The ancient Britons knew only six primitive ores, from which metals

* From the London Mining Journal, No. 847.

were produced; whereas the present scientific generation use fifty. The aggregate yield of minerals in this country is equivalant in value to about 25,000,000*l.* annually.

The Agricultural produce, of milk, meat, eggs, butter, and cheese, 3,000,000 tons, and 50,000,000*l.*

The ale, wine, and spirits consumed annually exceed 3,300,000 tons, and 54,000,000*l.*; whilst sugar, tea, and coffee scarcely reach 450,000 tons, and 27,000,000*l.*

Our Fisheries net 6,000,000*l.* annually.

In Manufactures, the cotton, woolen, linen, and silk altogether amount to 420,000 tons, and 95,000,000*l.*; whilst hardwares exhibit 360,000 tons, and 20,000,000*l.*; in addition to which 1250 tons of pins and needles are made yearly, worth 1,100,000*l.*

Earthenware, 160,000 tons, 3,500,000*l.*; glass, 58,000 tons, 1,680,000*l.*

The Gazette shows an average of four bankrupts daily throughout England and Wales.

In fact, the whole book is full of the best information that could be collected, and should be possessed by all interested in scientific, literary, or commercial pursuits.

---

*Trial and Description of Stevens' Patent Fan Paddle.**

On Saturday, December 6, a trial was made of the efficiency of this paddle, which is the invention of Mr. Lee Stevens. It consists of fixed oblique floats on the circumference of the wheel, and diminishing in surface towards the centre, like a lady's fan, which floats or segments, as the wheel revolves, press alternately right and left against the water, and by their oblique action spread the water as it were towards each side, abaft the paddle, and thus materially diminish the back water as compared with the ordinary paddle, and also the vibration on board the boat very considerably. The operation of the paddle is uniformly the same, whether the motion be ahead or astern. The trial above referred to was made entirely at the expense of the Iron Steamboat Company, who had one of their boats, namely, the *Twilight*, fitted with Mr. Stevens' fan floats in a modified form in wood, instead of iron. The inventor expects that when his ideas are carried out by the construction of the fan paddle wheels in iron, as originally intended, their advantage will be still more apparent.

Two vessels belonging to the Company, the *Bridegroom* and the *Twilight*, being twin boats of equal power, having oscillating engines of 12 horse power each, started together from Cadogan-pier with the tide, at a quarter to 2 o'clock, the paddles making 44 revolutions per minute. On reaching Vauxhall Bridge, the *Twilight* was some distance ahead, and on passing Waterloo Bridge, she was still further ahead, having passed it 40 seconds before the *Bridegroom*. On the *Twilight* reaching London Bridge, at five minutes past 2 o'clock, the *Bridegroom* was about three-fourths of the distance between the two bridges behind her. The revolutions of the paddles were at the rate of 44 per minute. On returning up the river against the tide, at 10 minutes past 2 o'clock, the *Bridegroom* was given

* From the London Railway Magazine, No. 653.

the side of the river, which was, of course, an advantage, the *Twilight* being all the time out in the river. The paddles revolved at the rate of 40 per minute, and the boats moved at the same speed until they passed Westminster Bridge; but on passing Vauxhall Bridge, the *Twilight* got considerably ahead, and on passing Chelsea Hospital, at 39 minutes past 2 o'clock, she was about 300 yards ahead of the *Bridegroom*, and the paddles were then making 44 revolutions per minute, until she arrived at Cadogan-pier. It was stated that the number of revolutions of the paddle wheels on board the *Bridegroom* averaged 44½ per minute, and on board the *Twilight* 42 per minute. The vibration in the *Twilight* was scarcely perceptible in the run both up and down the river, which, together with the steadiness of motion produced by the fan paddles, the effect was very agreeable.

It is understood that the fan paddle is to be applied to one of the large sea-going steamers, with a view to increase her speed, and to get rid of the vibration now caused by the ordinary paddles.

---

*To Increase the Illuminating Power of Gas.**

In one of your late numbers, you allude to a recent patent for improvements in the manufacture of gas, the object of which is to render the gases resulting from the decomposition of water suitable for lighting purposes, by passing them over cannel coal in the process of distillation. I witnessed some experiments of this nature with the gases obtained from wood in the manufacture of pyroligneous acid, and have myself, for some time past, been making a series, using several descriptions of slightly illuminating gas, but principally those given out by peat and the lowest quality of coals, and the results are highly interesting. I find that a certain volume of such gas when passed through a heated retort containing Lancashire cannel coal, becomes of much greater illuminating power than the same volume of such gas mechanically mixed in a gasholder with the gas given out by the cannel; indeed, some of my experiments show this increase to be at least 50 per cent. when our common coal gas is so treated, as 10,000 feet of it may be passed through the retorts containing a ton of Lancashire cannel in the process of distillation, and the result will be 20,000 feet of gas equal in quality to that given out by the cannel alone, and it incurs no perceptible deterioration by being retained in a gasholder for several days.—C. C.

The Collodion Process in Photography. *By* Fred. Scott Archer.†

I am anxious to communicate to those engaged in the Collodion process in Photography an improvement in the manipulation which I believe will be found to facilitate the process considerably. It is, the use of the upright glass bath for the nitrate of silver solution:—and I will endeavor, in as few words as possible, to explain my mode of using it. The bath is about three parts filled with a solution of nitrate of silver of the usual

* From the London Builder, No. 461.

† From the London Athenæum, November, 1851.

strength; and the prepared glass (as soon as the film of collodion has set) is plunged into it. The whole is then placed in its proper position in the camera, the focus having been previously obtained; and the light is thus allowed to act on the prepared film whilst in the bath of nitrate of silver. By this means great cleanliness is preserved in the manipulation, and very delicate pictures are obtained. I have used this bath during the whole of the summer and autumn; and several friends, at my suggestion, have adopted it with great success. The bath is made of two pieces of the best plate glass, connected together at the sides and bottom, and gradually tapering downwards so as to form a narrow wedge-shaped bath, the top being about three-eighths of an inch wide, and the bottom one-eighth. This bath is cemented into a wooden frame, having a closely fitting lid to prevent all dust falling into the solution.

13, *Tavistock Street, Covent Garden.*

A Simple Process for Precipitating the Cotton contained in Collodion. By THOMAS CATTELL, M. D., *M. R. C. S. Eng. &c., Braunston.**

A short time since, I ascertained that on mixing bisulphuret of carbon with collodion, an immediate precipitation or separation of the cotton takes place, leaving a limpid fluid consisting only of the solvent and precipitant.

The cotton presents the same fibrous appearance as though it had not been in a previous state of solution, and as gun-cotton would do if simply immersed in water. When dried (as much moisture as possible being first pressed out between folds of linen or bibulous paper) it cannot be distinguished from the dried pulp of the paper-maker.

This singular reaction of the bisulphuret on the collodion, would lead to the supposition that the gun-cotton performs the part of a base to the oxyde of ethyl, (ether,) for this substance is at once deprived of the peculiar properties which it possessed previous to solution.

It may serve also to explain more clearly the chemical composition of gun-cotton, or lignine, as acted on by nitric or nitrico-sulphuric acid.

Gutta Percha in Photography.†

At the meeting of the Photographic Club on Saturday last, Mr. Fry exhibited some charming pictures on glass, obtained by a combination of gutta percha and collodion. To the ordinary collodion—gun-cotton dissolved in ether—a small quantity of gutta percha is added, which readily dissolves. This is employed with the ordinary materials for the processes on glass,—the picture being developed by pyro-gallic acid. The extraordinary sensibility of this preparation may be inferred from the fact, that a positive copy from a glass negative has been obtained in five seconds by gas-light. The film formed on glass is far more adherent than the ordinary collodion or albumen:—we may, therefore, expect many valuable results from Mr. Fry's discovery.

*From the London Lancet for February, 1852.

† From the London Athenæum, December, 1851.

Snow Phenomena. *By* W. Gladstone.*

It may interest some of your readers to see the following illustration of the remarkable fall of snow mentioned by Mr. Birt in the *Athenæum* of November the 22d. It occurs in a pamphlet on Meteorology by Prof. Dove, of Berlin,—in relation to the formation of clouds of snow over plains which are situated at a distance from the cooling summits of mountains. He says, that an amateur once gathered together a large assembly in the concert hall of a northern residence. It was one of those icy, star-bright nights which are so aptly called "iron nights" in Sweden. In the room, however, there was a fearful crowd; and the heat was so great that several ladies fainted in consequence. An officer who was present sought to end this distressing state of things by attempting to open a window,—but this was impossible, so hard was it frozen to the sill. Like a second Alexander, he cut the Gordian knot by breaking a pane of glass:—and now, what happened? It *snowed* in the room! It is needless to add any comment on this, as the phenomenon explains itself.

The Planing of Iron and Casting of Glass.†

Messrs. Hawks and Crawshay, of the Gateshead Iron works, have just completed, for Messrs. R. W. Swinburne and Co., plate-glass manufacturers, South Shields, a huge plate of planed cast iron, to be used for the casting of glass. It is, we believe, the largest and heaviest plate of iron that was ever planed. Its dimensions are—length, 18 ft. 4 in.; breadth, 10 ft. 10 in.; depth, 7¼ in.; and its weight is 26 tons. Mr. Hosking, Messrs. Hawks and Crawshay's engineer, constructed a planing machine for the express purpose of executing the work; and it has the peculiarity —very dangerous in a joke or an argument, but of great value in a planing machine—of "cutting both ways." A smooth surface and a dead level have been obtained—great merits in a plate for glass casting; for the more perfect the level, the less the labor that is required, and the danger that is incurred, in communicating an even and polished surface to the glass. A smaller plate, weighing 20 tons, (also intended for Messrs. Swinburne's works,) will shortly be placed in the machine.—*Gateshead Observer*.

Cornish Engines.‡

The number of Pumping Engines reported for—

September, is 21; consumption of coal, 1512 tons; water raised, 13,000,000 tons, 10 fathoms high. The average duty of the whole is, therefore, 50,000,000 lbs., lifted one foot high, by the consumption of 94 lbs. of coal.

October, is 20; consumption of coal 1960 tons; water raised, 16,000,000 tons, 10 fathoms high. Average duty, 49,000,000 lbs., lifted one foot high, by 94 lbs. of coal.

November, is 21; consumption of coal, 1525 tons; water raised, 13,000,000 tons, 10 fathoms high. Average duty, 49,000,000 lbs., by 94 lbs. coal.—*Lean's Engine Reporter*.

* From the London Athenæum, December, 1851.

† From the London Mining Register, for December, 1851.

‡ From Herepath's Railway *Journal*.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, February 19, 1852.

S. V. Merrick, President, in the chair.
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary,

The minutes of the last meeting were read and approved.

A communication from Lieut. W. F. Maury, of the Washington Observatory, inviting the co-operation of the Institute on the subject of meteorological observations, was read, and referred to the Committee on Meteorology.

Donations were received from The Royal Astronomical Society, and Chas. T. Beke, Ph. D., London; Hon. James Cooper, U. S. Senate; A. C. Jones, Esq., New Orleans, La.; The Mercantile Library Association, Cincinnati, Ohio; The Maryland Institute for the Promotion of the Mechanic Arts, Baltimore, Md.; The New England Association of Railway Superintendents; T. H. Forsyth, Esq., Penn. Legislature; Lieut. H. S. Stellwagen, U. S. Navy; and Messrs. Theo. Code, John F. Frazer, Tyndale & Mitchell, John C. Trautwine, Oran Colton, and Frederick Fairthorne, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments in the month of January.

The Board of Managers and Standing Committees reported their minutes.

The Committee on the School of Design for Women presented their first Annual Report. On motion, 1000 copies were ordered to be printed for distribution under the authority of that committee.

To the Board of Managers of the Franklin Institute:

The Standing Committee on the School of Design for Women, present their first Annual Report. The establishment of such a branch in the Institute, although entirely cognate to its objects, was undoubtedly a novel and somewhat uncertain undertaking. The nucleus of the School had, however, been formed in an effort made by Mrs. Sarah Peter to enlarge the sphere of female occupation, and the results obtained by the limited means she could command, were so far successful as to warrant an appeal to the Institute to establish, and to the public to endow and support, such an institution.

That appeal was made, and cordially answered on the part of the Institute, and the subscriptions in aid of the School at length reached a sufficient amount to warrant the Committee in opening the School. This was done on the 3d of December, 1850, although the endowment and subscriptions had not reached the sum originally fixed upon as requisite for success. The Committee determined to make the experiment, and assumed the responsibility individually, of arranging its affairs so that it might be continued in operation for at least one year. A suite of rooms in the large building, No. 72 Walnut St., belonging to the American Fire Insurance Company, was rented, and plainly but comfortably furnished. Supplies of a few models, designs, and other elementary matters, were

ured. Mrs. Anne Hill, well known to our citizens as one of the t accomplished instructors in drawing, was elected Principal of the ool, and Mr. Charles N. Parmalee engaged as an instructor in Wood raving. In a few weeks the School was well filled with pupils, and oid and steady progress has crowned the labors of the teachers. Arements were made for the reception of pay pupils, and the fee gradu- according to the ability of the applicant to pay, but in no case did harge exceed five dollars per quarter. The most liberal foundation established for the admission of those whose circumstances did not t of any return from them for the instruction given. These admissions been regulated with such scrupulous delicacy and care of the feelings e applicants, by the ladies of the Committee, that free pupils are n only to them and to the Principal of the School.

ich of the pupils of Mrs. Peter's school as desired to continue, were itted into our school, and the one established by that lady was then d. The progress of many of those under our charge was soon suffi t to justify the opening of an industrial department, in which the knowe imparted in the School might be practically applied. A temporary gement of Mr. Fillot, as an instructor in the applications of the art esign, was made, and some designs for calicoes, paper hangings, oil s, and carpeting produced, evincing considerable skill and taste. r this preliminary trial, Mr. Fillot's connexion with the School ceased, an arrangement was made with Mr. Thomas W. Braidwood to take ge of the industrial department. The services of this gentleman ld have been obtained at the opening of the department, but for other pations of his, which then precluded him from giving a sufficient ion of his time to our pupils. Since the close of the summer vaca- the School may be said to have received its permanent organization, to consist of three departments.

irst, Drawing, from its elementary principles, through the course of s from prepared studies, to original compositions, and the applica- of coloring, and shading by crayons and pencils, so as to produce plete pictures.

is department is specially under the charge of Mrs. Hill, the Prin- of the School, and now contains thirty-two pupils.

econd, The Industrial Department, in which the applications of draw- shading, and coloring, to the art of design, are taught. In this de- ent, original sketches for designs in calico printing, paper hangings, loths, carpets, furniture, &c., are prepared and offered for sale. ications are also received from manufacturers and others for the pre- ion of designs from sketches or ideas furnished by such applicants, at particular branches of trade, or special tastes, may be consulted the best promise of advantage or success. Designs and patterns pre- l in the School are secured under the copyright law of the United s, which, to the extent that the law gives any security, will protect who purchase designs from the School in the entire property in designs, and tend to avoid piracy of the patterns by others. The s in this department evince much taste and skill, and all that is now ng to give it activity and entire success, is a full supply of orders.

from our extensive manufactories, which will stimulate the talents of pupils to the production of original designs, or combinations of exist patterns, equalling any that may come from foreign countries.

This department, as before stated, is now under the charge of] Thomas W. Braidwood, and contains sixteen pupils.

Third, The Department of Wood Engraving and Lithography, w six pupils. In these branches the pupils have made very satisfactory p gress, and in the orders for work there has been a good degree of couragement. Here, as well as in the Industrial Department before ticed, there is abundant room for the display of original talent and tast

Independently of the constant demand for wood engraving and lit graphy, for the illustration of works treating on the arts and sciences, on natural history, there are great outlets for labor in this branch in embellishment of our periodical literature, and the Committee anticip that all the pupils who may perfect themselves in the knowledge of th arts, will command constant and well paid employment.

The general arrangements of the School are of the most liberal comprehensive character.

It has been deemed desirable to instil into the minds of the pupils th while its doors are freely open to those whose circumstances render th unable to pay for instruction, yet in all cases where a reasonable fee be paid it should be rendered by the pupil.

So soon as the instruction given fits a pupil for one of the applied partments, she is placed in it, and all her earnings, except a sufficient centage, (retained to remunerate the School for the cost of the materi and the use of the tools and implements,) are paid over to her.

The whole number of pupils admitted from December 3, 1850 January 1, 1852, was 94, and on the last named day, 54 remained in School.

The amount received for tuition fees to the same time, was $208 for Designs, Engraving, &c., $448·25.

A particular account of the receipts and payments are herewith mitted in the account of the Treasurer of the School.

We have to regret that, owing to the failure of Messrs. Harnden to pay an order for forty dollars drawn on them, the proceeds of were to be invested in the purchase of models, tools, &c., in Euro have been rather more limited in our means for instruction than pected, but the knowledge and experience of our instructors ha satisfactory extent, supplied the deficiency.

As Mrs. Sarah Peter, (who is justly entitled to be deemed the of the School,) was about to visit Europe, the Committee reque she would make an examination of the several Schools of Desig lished there, and on her return report their condition and manag as to enable us to modify the arrangements of our own Scho we be found deficient in any essential particular.

In order to give to her introduction to such institutions the we official sanction, a formal letter was prepared and delivered to the seal of the Franklin Institute, requesting all in charge of lishments abroad, to recognise her as the agent of the Sch *further* the usefulness of such institutions by a full and free c

tion of plans and practical applications. No report has yet been received from her, but enough has reached us of the results of the visits she has already made, to prove that the intelligent philanthropy which suggested the founding of our School, will return to us clothed with an enlarged knowledge and renewed determination to make it quite equal to any she may have examined abroad.

Since the establishment of our School, one of the same character and objects has been opened in the City of Boston, and another has been, or is about to be, founded in the City of New York.

On the first of January last, the question of continuing the School for another year was decided affirmatively by the Committee, under a confident reliance that those who had already patronized the institution by their subscriptions, would again supply the means for its support.

Arrangements are accordingly in progress for a call on the liberal minded of our citizens, for the subscription of a sufficient amount to relieve the Committee from the individual responsibility assumed by them in the opening and maintenance of the School for the past year, and also for such additional subscriptions as will place it on a well endowed and permanent basis.

The grounds for the support of such an institution have been heretofore so thoroughly placed before the public, as to render it unnecessary to reiterate them in this report.

No one claiming a spark of philanthropic feeling, can witness the limited means at the command of women for obtaining a livelihood by labor, without a deep sense of regret, and a consciousness that something should be done to extend those means.

The field we have opened is almost limitless in its capacity, and will grow and increase with the increase of population and wealth. The small amount required for the annual support of such a school, is as nothing, compared with the great advantages flowing from it in a moral and social aspect.

The Schools of Boston and New York are reported to be already very handsomely endowed, and the Committee earnestly hope that the members of the Institute, and the public generally, will, by a visit to the School, and personal examination into its claims and merits, satisfy themselves of its importance and value, and immediately place it, by the liberality of their contributions, on a sure and permanent basis.

Assuming the expenditures of the past year as a basis, and estimating that the receipts for tuition and for work done, will somewhat exceed the amount derived from the same sources in the year 1851, the Committee consider that the sum of three thousand dollars will be wanted for 1852; and for the purpose of procuring said amount, and also for permanently endowing the School, they recommend the adoption of the most energetic measures.

School of Design, Feb. 10, 1852.

S. V. Merrick,
D. S. Brown,
F. Fraley,
Sarah V. Merrick,
Mary Lawson,
} *Committee.*

The Committee on the Library reported the regulations under which the pupils of the School of Design for Women will be permitted to take books from the Library of the Institute.

The Committee on the Cabinet of Minerals and Geological specimens, reported that the Heidelberg Collection of Geological Specimens presented at the last meeting, is arranged in the Cabinet, and open for the inspection of the members.

The Trustees of the Elliott Cresson Fund, presented their annual report.

The special committee, appointed to memorialize the City Councils on the security of buildings from fire, and to ask of the Legislature the passage of laws in relation to the construction of buildings in the City and County of Philadelphia, with regard to ventilation and light, reported on the subjects.

Resignations of membership in the Institute (2) were read and accepted.

New candidates for membership in the Institute (21) were proposed, and the candidates (15) proposed at the last meeting were duly elected.

The Standing Committees for the ensuing year were nominated by the President, and appointed as follows:

On the Library.	*Cabinet of Models.*	*On Exhibitions.*
John Allen,	George Ashmead,	John Agnew,
Spencer Bonsall,	Job Bartlett,	John E. Addicks,
James H. Cresson,	Harman Baugh,	H. P. M. Birkinbine,
George Erety,	Henry Huber, Jr.,	John C. Cresson,
George W. Farr,	Lambert Keating, Jr.,	Geo. W. Conarroe,
Wm. S. Levering,	Henry Newsham,	Owen Evans,
William A. Rolin,	Charles J. Shain,	William T. Forsyth,
Jacob D. Sheble,	John H. Towne,	William D. Parrish,
Clement W. Smith,	James A. Wimer,	Geo. W. Smith,
Dr. Geo. J. Zeigler.	Charles Welsh.	Alan Wood.
Cabinet of Minerals and Geological Specimens.	*On Meetings.*	*Cabinet of Arts and Manufactures.*
John F. Frazer,	Joaquim Bishop,	James C. Booth,
Wm. W. Fleming,	George N. Eckert,	Joseph J. Barras,
Andrew Mayer,	Robert Frazer,	Charles M. Ghrisky,
Angus N. Macpherson,	J. Vaughan Merrick,	William Harris,
Dr. B. Howard Rand,	Dr. B. Howard Rand,	Henry H. Kelley,
Percival Roberts,	Geo. W. Smith,	William P. Troth,
Charles E. Smith,	Chas. E. Smith,	Gustavus L. Thomas,
Dr. L. Turnbull,	John C. Trautwine,	Eliashib Tracy,
John C. Trautwine,	Dr. L. Turnbull,	Isaac S. Williams,
Dr. Chas. M. Wetherill.	Dr. C. M. Wetherill.	Thomas J. Weygandt.

On Meteorology.

Samuel W. Black,	L. C. Francis,
Dr. Silas S. Brooks,	Dr. David Gilbert,
Charles M. Cresson,	James A. Kirkpatrick,
Edmund Draper,	Dr. James A. Meigs,
Owen Evans,	Charles S. Rand.

Dr. Rand, Chairman of the Committee on Meetings, exhibited a model of a new form of artificial leg, the invention of Mr. Jonathan Russel, of this City. Its peculiarity consists in its possessing but a single spring, the power of which, by an ingenious arrangement of attached cords, is made to give the requisite motion and elasticity to the several joints.

In the thigh piece of the leg is attached a cord, which passes down in front of the bolt of the knee joint; in the body of the leg piece, this cord is attached to a spiral spring, from the lower end of which proceed two cords, which pass around a pulley situated just above the ankle joint; one of these cords is attached to the inner and upper side of the foot-piece, while the other, passing under the tenons of the ankle and toe joint, is inserted on the under side of the latter.

Connected with the spiral spring is a bent lever, so arranged that when pressure is made on the toes or heel, its shorter arm is thrown into a notch in the thigh piece, and thus motion in the knee joint prevented, and the leg rendered steady.

Dr. Rand also presented to the notice of the members, an improved apparatus for boring rock, the invention of Mr. John Thomson, of Kensington. The boring rod is attached by a swivel joint at its upper end, to a flat rod twisted at right angles on its own axis, and working through a frame. By drawing up this flat piece, a rotating motion is given to the boring rod, the degree of which may be regulated by adjusting the guiding frame.

Mr. Jonathan Russel exhibited a machine of his own invention, for turning irregular forms to pattern. The three preceding inventions have been submitted to the Committee on Science and the Arts.

Dr. Turnbull brought before the Institute, a very fine specimen of a true delft vase, presented by Messrs. Tyndale & Mitchell, to the cabinet of the Institute. The vase possessed all the characteristics of the true delft ware, being of soft pottery, almost as light as wood, very beautifully ornamented with delicate painted flowers, with leaves and fruit in relief. Dr. Turnbull stated that this kind of pottery was made in Holland, in the 15th century, as a true delft tile in the cabinet has that date upon it, and that the Dutch ware, made at Dalft, was called the parent of pottery. It is the most celebrated, not only on account of its singularity of form and color, but also for its excellent qualities; it is remarkable for the beauty of its enamel, which is not a shining white, but slightly tinged with blue, and presents a smooth and even surface, allowing ornaments of every color to be placed upon without disturbing the enamel, or impairing the brilliancy or distinctness of the colors. The prevailing color is blue, like the tile in the cabinet. The articles of delft ware manufactured for ornaments were chiefly copied from the old Japan porcelain, both in form and color. The hideous imaginary animals of the chimœra class; the three-ringed bottle, the tall and shapeless beaker, and the large circular dish, may still be seen in most collections of Dutch delft. It is to the introduction of the fine English wares, as well as of oriental porcelain, which came into general use in the 17th century in Europe, that the decline of the manufacture of fine pottery is to be attributed. The complicated forms, the fine and delicate paintings required, enhanced too much the price of a ware, of which the materials was less esteemed than that of the new sort which then appeared, so that the fine enamelled, soft pottery ceased to be made in the 17th century, and the manufacture degenerated to very ordinary ware.

Dr. Turnbull also presented to the meeting a specimen of a brick from

the Coliseum at Rome, which Lieut. Stellwagen, U. S. Navy, kindly presented for the cabinet of arts and manufactures of the Institute.

Mr. I. W. P. Lewis, C. E., submitted to the meeting two models, representing a new method of constructing foundations for light-houses, piers, &c., exposed to the force of the sea; also a number of drawings of celebrated light-houses. In describing these, Mr. Lewis demonstrated that there are but two methods of erecting permanent structures of this character; 1st, by opposing "*strength*" to the shock of the sea, as in the case of screw pile foundations; and 2d, by opposing "*weight to weight*," as in the Eddystone, Bell Rock, and other towers.

The stability of all these solid structures is due to their weight, and not to the curvilinear outline, of which so much has been said. Mr. Lewis considered these curved outlines as a useless refinement, and demonstrated the frustum of a cone to be the solid of greatest stability for such purposes. The Bell Rock light-house, he considered as a caricature of the Eddystone, the curved base being carried some five feet beyond the line of pressure of the superstructure. The Skerryvore light-house is another striking example of curved outline, more absurd than any one of the kind. The curve of this tower is a hyperbola, and the cost of executing it in granite, must have added a very large sum to the extravagant cost of the tower. The only reason offered by the architect for adopting this in lieu of a simple conical frustum is, that it would bring the centre of gravity of the tower about "*two feet*" lower.

Mr. Lewis exhibited a drawing of the second Eddystone light-house, erected by John Rudyerd in 1706, as a satisfactory example to prove that weight and simplicity of form are the requisites to ensure stability. Rudyerd's light-house was built of wood in the form of a conic frustum, 61 feet high, 22 feet 8 inches diameter at the base, and 14 feet 3 inches diameter at the top. The timber used was the best of oak, laid stratum superstratum, and ballasted at three intervals with about 356 tons of granite; the strata of ballast being separated by courses of timber. The base was secured to the sloping rock, by cutting horizontal benches thereon, and inserting in the rock, stout iron anchors, the upper parts of which were bolted to the timber. The surface of the tower was formed of upright timber, 9 by 12 inches square, bolted to the interior work, and caulked and pitched like the seams of a ship. This light-house, the construction of which, "Smeaton" eulogizes in very strong language, withstood the fury of the ocean for 46 years, and was then destroyed, not by water, but by fire, being burnt down in 1755.

The present Eddystone light-house, erected 1756-9, by John Smeaton, is a fine specimen of masonry, and is justly looked upon as one of the most remarkable structures in the world; but Smeaton does not give any satisfactory reasons for adopting a curved outline, though this was doubtless suggested to him by the sloping surface of the rock on which he was to build his tower. The building is small, being only 68 feet high, with a diameter of 26 feet on the lowest complete course of the masonry, and 15 feet diameter at the top; its weight is 1817 tons, and the force of a heavy sea falling on its surface at high water, would probably be about 1200 tons, allowing this force to be 6000 lbs. upon a square foot.

The models designed by Mr. Lewis, consisted of a series of cast iron

blocks, moulded into peculiar dove-tailed forms, by means of which several very great advantages are obtained; 1st, a "*vertical band;*" in structures of stone, "horizontal band" is easily obtained, so that each course of masonry may be united as one stone. Such is the peculiarity of Smeaton's Eddystone. But to obtain vertical band in stone masonry, would be attended with extravagant cost and much difficulty. The advantages of such a band are, that during the erection of a tower, none of the blocks could be dislodged from their beds, by any force of the sea, however great this force might be; and when complete, the tower would resist any force on the upper part, tending to break and overthrow it, with the whole strength of its material.

2d, By using cast iron in place of stone, nearly three times the weight is concentrated in each cubic foot of material. Mr. Lewis exhibited a design for a light-house tower, 90 feet high, 25 feet diameter at base, and 14 feet diameter at top; the first 40 feet constructed of two concentric courses of cast iron blocks, dove-tailed together vertically and horizontally, the interior void filled with concrete, and the mass weighing 1531 tons. The superstructure of the tower consisted of cast iron plates lined with a course of brick work, weighing altogether 250 tons, making a total of 1781 tons. The force of the sea striking against the lower 32 feet of the tower, at the rate of 6000 lbs. per square foot, would be 1138 tons, leaving 643 tons surplus weight for the stability.

Discussion took place as to the means of protecting these iron towers against corrosion, &c. Mr. Lewis mentioned the various methods that had been tried, did not consider any of them perfectly satisfactory, but thought (unless a part of the structure was constantly under water,) the iron could be secured against injurious decay. Mr. Tilghman suggested the patent method of coating the iron with fused silicious sand at the moment of casting, which forms a rough but perfect glazing over the iron, and is of course impervious to water.

BIBLIOGRAPHICAL NOTICES.

Appleton's Dictionary of Machines, Mechanics, Engine Work, and Engineering.

Since our former notice of this work, in which we took occasion to express our opinion that the explanation given by the Messrs. Appletons for their omission of Mr. Byrne's name from the title-pages of the book of which he was publicly proclaimed the editor, was unsatisfactory; we have received a letter from Mr. Julius W. Adams, which, after explaining the whole circumstances of the case, closes as follows: "I repeat, *that I, and I alone, superintended, wrote, and collected, collated, composed, examined, and prepared for publication, the second volume of Appleton's Dictionary of Machinery.*" By referring to the January number of this Journal, our readers will see that this makes a direct issue with Mr. Byrne's statement, and the character of Mr. Adams, as well as the well known respectability of the firm of Appleton, entitle him to credit for his assertion. In reference to our final query, it is stated that the first title-page of the second volume

was printed with the first number of the volume, and upon its compl
was corrected.

The facts of the case are now before those who take an interest i
and we leave it with the simple declaration that, whoever edited it,
a very good book.]

"Report of the Board of Officers appointed to inquire into the Conditi the Light-House Establishment."

The almost universal complaint of the utter inefficiency of our li houses, at length led Congress to take measures for an examination the truth of the reports, and the causes of the defects, if such exi and the present pamphlet contains extracts from the Report of the B appointed under the resolution of Congress, and composed of two offi of high rank in the Navy, two officers of Engineers in the Army, Superintendent of the Coast Survey, and a Lieutenant in the Nav Secretary.

Their Report discloses a state of things in reference to our light-ho which is highly discreditable to the nation, and requires instant cha

It appears that there is no system whatever, no proper method of de mining the position or character of lights; that the lights themselves of a kind obsolete in Europe, badly placed, badly constructed, badly nished, and badly tended; that the towers are not always well pla and are very frequently badly built; and that, with a very low us effect, our light-houses cost as much as, or more than a proper syste first rate lights.

The remedy proposed is a simple one, the establishment of a pe nent Light-House Board, properly constituted, who shall superintend arrangement of all the lights; employ competent persons to select pr sites, and determine the character of the lights, which are to be of most efficient construction; competent engineers to design the light-ho and superintend their erection; proper persons to test the quality of supplies purchased, and to deliver them in proper quantities to the k ers; and finally, shall draw up a set of proper regulations for the] keepers, and see them attended to.

With such a system, we should be extending an efficient protecti the immense foreign and domestic commerce, which is now daily ri along our dangerous and ill-lighted coast, and should thus be doing duty in a matter which we have heretofore shamefully neglected. It be hoped that the proper legislation will at once receive the attentio Congress, and will not be subjected to the usual delays from frivolity political intriguing.

In a subsequent number, we will copy the conclusions of the Bo for which we have not room at present. I

Errata.

Page 119, line 24, for "aperture at *a*," read "aperture at *d*."
" 120, " 14, for "increase the width," read "diminish the width."
" " " 25, for "aperture," read "apertures."

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

APRIL, 1852.

CIVIL ENGINEERING.

Philadelphia and Reading Railroad.

Few persons are aware of the magnitude and importance of this work. The following extracts from their published report for the past year, will present at a glance many items of importance.

Travel equal to	57,593	through passengers.
Freight of merchandise,	63,807	tons.
" coal,	1,650,270	"
Wood consumed on road,	61,222	cords.
Coal " anthracite,	5,640	tons.
" " bituminous,	4,023	"

Cost of tallow, lard, grease, and cotton waste,	$10,292·75
Wages of engineers, firemen, conductors, &c., on road,	132,068·02
" workmen in workshops,	175,820·59
Cost of wrought iron and steel used in workshops,	20,652·22
" cast iron " "	4,217·03
" copper, tin, spelter, lead " "	5,328·76
" timber and lumber " "	12,116·70
" anthracite coal " "	4,978·54
" bituminous " " "	3,610·95
" wheels, axles, and tires " "	26,354·93
" hardware, paints, oils, leather, stone, and lime,	13,638·92

Breakage of Coal Cars.

In 1848	1 car	for	every	1485	tons of	coal	carried.
1849	1	"	"	2282	"	"	"
1850	1	"	"	2490	"	"	"
1851	1	"	"	3114	"	"	"

Rails removed from track.

In 1848	1 bar	for	every	266	tons of	coal	carried.
1849	1	"	"	314	"	"	"
1850	1	"	"	332	"	"	"
1851	1	"	"	279	"	"	"

Wear of different kinds of rails per cent. per annum.

	Average of 1848-9.	1850.	1851.	
Old English, 60 lbs. per yard,	6·2	8·3	9·4	heavy track.
" 52 " "	1·4	1·2	2·6	
" 45 " "	1·3	1·4	1·9	light track.
Several superior patterns called Erie,		14·8	17·8	
American Phœnixville, 60 lb. pr. yd.	0·7	4·8	6·3	heavy track.
" Danville, " "			1·7	

Employed on the Road.

	59	first class locomotives.
	20	second "
	7	third "
	3	fourth "
Total,	89	

	1	8-wheel iron coal car.
	2982	4-wheel " "
	1596	4-wheel wooden coal cars.
Total,	4579	

21 8-wheel passenger cars.
5 8-wheel baggage "
2 8-wheel mail and express cars.

STATEMENT B.—*Table of Names, Weights, Makers, Condition, and present duty of all Locomotive Engines owned by the Railroad Company. November 20, 1851.*

Names.	Class.	Weight.	Maker.		When first ran.		Miles Run. Past Year.	Miles Run. Total to Date.	Condition and Duty.
Atlas, . .	1st	27·0	Baldwin,	Philadelphia.	April,	1846	16,206	84,325	At work, Falls Grade.
Hercules, .	"	27·0	do	do	"	"	16,107	80,486	do do
Texas, .	"	22·5	do	do	"	"	20,892	103,914	do in Coal Trade.
Alabama, .	"	22·5	do	do	"	"	20,984	109,990	In shop, under repair.
Kentucky, .	"	22·5	do	do	"	"	22,883	94,631	At work, in Coal Trade.
Indiana, . .	"	21·9	do	do	"	"	15,083	104,733	do do
Princeton, .	"	22·5	do	do	May,	"	25,031	107,068	do do
Montezuma, .	"	22·5	do	do	July,	"	20,945	106,518	do do
Amazon, .	"	22·5	do	do	May,	"	22,758	104,285	do do
Warrior, . .	"	22·5	do	do	"	"	19,853	102,836	In shop, under repair.
Florida, .	"	22·5	do	do	July,	"	21,795	103,680	At work, in Coal Trade.
Washington, .	"	22·5	do	do	June,	"	16,951	94,861	In shop, under repair.
Empire, .	"	22·5	do	do	May,	"	16,310	111,027	At work, in Coal Trade.
Pocahontas, .	"	22·5	do	do	June,	"	15,203	103,394	In shop, under repair.
Yorktown, .	"	22·5	do	do	"	"	21,604	109,135	At work, in Coal Trade.
Rio Grande, .	"	20·1	do	do	July,	"	21,172	100,792	In shop, under repair.
United States,	"	18·6	do	do	"	1844	14,316	129,462	At work, in Coal Trade.
New England,	"	19·7	do	do	"	"	21,300	134,124	do do
New York, .	"	19·1	do	do	August,	"	20,852	137,567	do do
Ontario, . .	"	19·1	do	do	"	"	19,101	137,762	do do
Virginia, .	"	19·1	do	do	September	"	17,264	131,148	do do
Hudson, . .	"	19·6	do	do	October,	"	20,052	112,617	In shop, under repair.
Niagara, .	"	19·6	do	do	April,	1845	19,016	120,764	At work, in Coal Trade.
Pacific, . .	"	19·5	do	do	"	"	20,960	116,180	do do
Independence,	"	19·5	do	do	May,	"	20,931	125,924	do do
Oregon, . .	"	19·5	do	do	"	"	21,271	115,816	do do
St. Lawrence,	"	19·5	do	do	June,	"	21,914	117,125	do do
Constitution, .	"	19·5	do	do	"	"	21,103	98,615	do do
Champlain, .	"	20·1	do	do	September	"	21,460	113,781	do do

STATEMENT E.—(Continued.

Names.	Class.	Weight.	Maker.	When first ran.	Miles Ran. Past Year.	Miles Ran. Total to Date.	Condition and Duty.
Dauphin,	1st	23·7	Baldwin, Philadelphia.	October, 1850	22,212	25,084	At work, in Coal Trade.
Baltic,	"	22·9	do do	" "	23,735	27,352	do do
Perry,	"	23·8	do do	" "	22,942	27,308	do do
Seminole,	2d	13·1	do do	Febru'y, 1840	14,051	160,005	do Wood Train.
Baltimore,	1st	28·0	Ross Winans, Baltimore.	June, 1847	12,438	71,525	At work, in Coal Trade.
Maryland,	"	28·0	do do	September, "	10,105	56,862	do do
Delaware,	"	28·0	do do	" "	16,826	68,560	do do
Ohio,	"	28·0	do do	" "	13,454	69,609	In shop, under repair.
Patapsco,	"	24·6	do do	October, 1850	19,156	23,769	At work, in Coal Trade.
Minesota,	"	22·5	do do	November, "	16,670	18,077	In shop, under repair.
Georgia,	"	24·1	do do	October, "	23,643	26,713	At work, in Coal Trade.
Louisiana,	"	23·9	do do	November, "	21,870	23,985	do do
Mohawk,	1st	19·4	Norris, Schenectady.	October, "	22,439	24,922	At work, Passenger Train.
Genesee,	"	19·5	do do	" "	18,472	21,151	do do
Allegheny,	1st	23·9	Reading Railroad Company.	Novem'r, 1851	381	381	At work, in Coal Trade.
Wyoming,	"	19·6	do do	Febru'y, 1847	14,115	78,491	do Lateral Railroads.
Palo Alto,	"	20·8	do do	May, "	18,474	80,802	do do
Monterey,	"	19·9	do do	June, "	18,352	75,980	do do
Saratoga,	"	19·2	Rebuilt by do	" 1842	12,769	114,500	In order, ready for use.
Mahanoy,	"	20·2	do do	May, "	13,291	125,862	do do
Atlantic,	"	20·1	do do	August, 1844	19,925	113,012	At work, in Coal Trade.
Philadelphia,	"	20·2	do do	Septem'r, 1851	2,901	2,901	do do
California,	"	21·5	do do	May, 1848	20,916	63,500	do do
Chesapeake,	"	20·0	do do	March, 1847	10,971	66,814	do Philadelphia Branch.
Monocacy,	2d	16·4	do do	" 1842	17,091	173,814	In order, ready for use.
Reading,	"	16·2	do do	October, "	10,041	140,577	At work, Roadway Department.
Schuylkill,	"	14·7	do do	July, 1843	10,906	88,218	do Richmond Wharves.
Osceola,	"	14·8	do do	August, "	11,152	79,592	do do
Huron,	"	14·8	do do	" "	10,604	90,920	do do
Erie,	"	14·8	do do	" "	10,609	91,509	do do
Ontalaunee,	"	14·6	do do	July, "	10,877	89,933	do do

STATEMENT E.—(Continued.)

Names.	Class.	Weight.	Maker.	When first ran.		Miles Run. Past Year.	Miles Run. Total to Date.	Condition and Duty.
Buena Vista,	3d	16·9	Reading Railroad Company.	April,	1848	17,473	59,482	In order, ready for use.
Vera Cruz,	"	16·7	do do	"	"	19,909	83,202	At work, Passenger Train.
Cerro Gordo,	"	16·8	do do	July,	"	23,330	76,044	do do
Gazelle,	3d	11·0	Rebuilt by do	March,	1841	14,328	190,436	do Roadway Department.
Atalanta,	"	10·3	do do	April,	"	22,170	180,732	In shop, under repair.
Antelope,	"	9·3	do do	June,	1838	8,443	122,030	At work, Valley Passenger Train.
Stag,	4th	14·6	Reading do	Febru'y	1851	8,901	8,901	do Roadway Department.
Ariel,	"	4·3	do do	"	1846	11,093	76,675	In shop, under repair.
Witch,	"	5·2	do do	October,	1847	14,557	49,085	At work, Lateral Railroads.
Maine,	1st	20·0	Boston Locomotive Works,	July,	1849	20,865	48,835	At work, Freight Train.
Massachusetts,	"	20·1	do do	"	"	16,158	45,381	In shop, under repair.
Vermont,	"	20·2	do do	"	"	25,283	52,515	At work, Freight Train.
Carolina,	1st	18·3	Newcastle Company.	April,	1846	12,113	74,548	do Lateral Railroads.
Missouri,	"	18·6	do do	August,	"	17,536	83,111	do do
Columbus,	"	18·5	do do	April,	1844	8,904	80,775	In shop, under repair.
Tuscarora,	3d	11·8	do do	Novem'r,	1842	8,375	87,080	At work, Lateral Railroads.
Pennsylvania,	"	11·4	do do	April,	1843	10,246	86,320	do do
Manatawny,	2d	13·8	Norris, Philadelphia.	October,	1842	11,508	159,388	At work, Extra Train.
America,	"	13·4	do do	"	"	11,478	140,131	do Wood Train.
Conestoga,	2d	11·8	Locks and Canals Company,	May,	1849	6,865	85,995	At work, Lateral Railroads.
Shamokin,	"	11·8	do do	July,	"	5,940	82,987	do do
Potomac,	"	11·8	do do	August,	"	9,056	103,088	do do
Roanoke,	"	11·8	do do	Septem'r,	"	6,872	78,164	do do
Engineer,	3d	8·8	Braithwaite & Co., London,	May,	1838	12,959	141,100	At work, Roadway Department.
Rocket,	"	8·4	do do	"	"	12,484	169,957	do do
Planet,	"	8·4	do do	August,	"	12,454	153,554	do do
Hecla,	"	8·4	do do	July,	1840	1,627	135,351	do Lateral Railroads.
Gowan and Marx,	2d	11·0	Eastwick & Harrison, Philadelphia.	January,	"	6,025	101,542	At work, Reading Depot.
Cambridge,	1st	25·5	Davenport, Bridges & Kirk, Cambridgeport.	June,	1850	16,976	27,010	do in Coal Trade.

CONDENSED TABLE, *Showing Condition and Employment of all Engines owned by the Philadelphia and Reading Railroad Company.*

How Employed.	1st. Class.	2d. Class.	3d. Class.	4th. Class.	Total.
In daily use, in good order, on Reading or Lateral Roads,	47	18	6	2	73
In workshops, under Repair,	10	0	1	1	12
In good order, ready for use,	2	2	0	0	4
Totals,	59	20	7	3	89

STATEMENT F.—*Work and Repairs of all Locomotive Engines owned by the Philadelphia and Reading Railroad Company, for the year ending November* 30, 1851.

MILES RAN.

How employed.	Classes.				Total.
	1st.	2d.	3d.	4th.	
Reading Railroad Transportation Department. . . .	990,915	206,660	10,901	21,075	1,229,551
Reading Railroad Readway Department, ...	13,170		14,597	7,194	34,961
Reading Railroad Renewal Department, ...					
September Freshet, and re-building State Road, . . .	485		36,023		36,508
Total Reading Railroad, . .	1,004,570	206,660	61,521	28,269	1,301,020
On Lateral Roads in Coal Region,	87,757	43,769	22,944	6,282	160,752
Total, ...	1,092,327	250,429	84,465	34,551	1,461,772

Total number of tons hauled 1 mile, exclusive of engine and tender,	366,157,599
Average weight of loaded coal trains down, " "	622
" " empty coal trains up, " "	208
" " passenger train, " "	54

All tons of 2,000 lbs.

COST OF REPAIRS OF ENGINES.

Wages of all mechanics, ...	$61,715 42
Materials, iron, steel, brass, &c., ...	25,173 40
Superintendence, tools, paints, &c., ...	10,861 10
	$97,749 92

Total number of miles ran by all engines owned and used by Company from May, 1838, to November 30, 1851,	9,371,217
Total number of tons hauled between same dates,	2,140,289,471

STATEMENT G.—*Cost of Repairs and Renewals of Coal, Freight, and Passenger Cars on the Philadelphia and Reading Railroad, for the year ending November* 30, 1851.

COAL, FREIGHT, AND WOOD CARS.

Wages of all mechanics, ...	$79,681 16
Timber, iron, steel, and all metals, ...	60,110 56
Superintendence, tools, paints, oils, &c., ...	13,979 17
Total,	$153,770 89

COST OF REPAIRS OF PASSENGER CARS.

Wages of all mechanics, ...	$3,978 64
Iron, steel, timber, &c., ...	3,528 30
Superintendence, tools, paints, varnish, &c., . .	938 37
Total,	$8,445 31

STATEMENT G.—*Cost of Repairs and Renewals of Coal, Freight, and Passenger Cars on the Philadelphia and Reading Railroad, for the year ending November* 30, 1851.

COAL, FREIGHT, AND WOOD CARS.

Wages of all mechanics, ...	$79,681 16
Timber, iron, steel, and all metals, ...	60,110 56
Superintendence, tools, paints, oils, &c., . .	13,979 17
Total,	$153,770 89

COST OF REPAIRS OF PASSENGER CARS.

Wages of all mechanics, . .	$3,978 64
Iron, steel, timber, &c., ...	3,528 30
Superintendence, tools, paints, varnish, &c.,	938 37
Total,	$8,445 31

STATEMENT H.—*Items of Cost, in detail, of Hauling Coal on the Philadelphia and Reading Railroad, for the year ending November* 30, 1851.

Per round trip of 190 miles, from Coal Region to Tide Water and back, with empty cars, transporting an average load of 368 tons of Coal each Train.

Items of Cost.	No.	Description.	Average Rate.	Amount.
Wages of Engineer, ...	2	Days.	2·90	5 80
" Fireman, ...	2	"	1·59	3 18
" Conductor, ...	2	"	1·50	3 00
" Brakeman, ...	6	"	1·18	7 08
Wood for Fuel, including Firing up, . .	11·87	Cords.	4.41	52 35
Oil for Engine and Tender, including Lamps,	2·36	Gallons.	·90	2 12
Oil and Tallow for Cars, ...	368	Tons.	·01⅓	4 91
Repairs of Engine and Tender, ...	190	Miles.	8·53	16 20
" Coal Cars, ...	368	Tons.	8·4	30 91
Supplying water, ...	12	M. Gallons.	·06	72
Assistant Engines at Falls Grade	368	Tons.	1·34	4 93
Car Couplers and Greasers, Time-keepers, Dispatchers, and Turning Crews, . .	368	"	1·02	3 75
Allowance for Engines laying over, Assistant Engines in snow storms, &c., and all other contingent expenses, ...	368	"	1·87	6 88
Equal to 38·54 cents per Ton.				$141 83

STATEMENT K.—*Items of Cost, in detail, of running Passenger Trains on the Philadelphia and Reading Railroad, for the year ending November* 30, 1851.

PER DAILY TRIP OF 92 MILES.

Items of Cost.	No.	Description.	Average Rate.	Amount.
Wages of Engineer,	1	Day.		2 25
" Fireman,	1	"		1 40
" Conductor,	1	"		1 81
" Baggage Master,	1	"		1 12
" Brakeman,	1	"		1 10
Wood for Fuel, including firing up,	2·6	Cords.	4·46	11 59
Water used,	3	M. Gallons.	·06	18
Oil for Engine and Tender,	·94	Gallons.	·95	89
Oil and Grease for Cars,				59
Repairs of Engine,	92	Miles.	·06	5 52
" and Refitting Cars,				8 04
Hands at Depots, Extra Engines, &c.,				2 62
Sundries for trains,				1 23
Equal to, at 54·8, through Passengers per Train, 69·9 cents per Passenger.				$38 34

STATEMENT L.—*Items of Cost, in detail, of running Freight Trains on the Philadelphia and Reading Railroad, for the Year ending November* 30, 1851.

Items of Cost.	No.	Description.	Average Rate.	Amount.
Wages of Engineer,	1	Day.		2 87
" Fireman,	1	"		1 44
" Conductor,	1	"		1 54
" Brakemen,	3	"	1·21	3 64
Wood for fuel, including Firing up,	4·25	Cords	4·49	19 06
Oil and Tallow, for Engine and Tender,				92
Oil and Grease for Cars,	102·6	Tons.	0·12	1 23
Repairs of Engine and Tender,	92	Miles.	5·42	4 99
" Cars,	102·6	Tons.	16·48	16 91
Depot Hands, and other Depot expenses,				16 08
Water used,	4	M. Gallons.	0·06	25
Renewals of Sundry Articles, Goods damaged, &c.	102·6	Tons.	0·21	2 16
Equal to 69·2 cents per Ton.				$71 09

STATEMENT N.—*Points of Supply, and Distribution of Coal, on the Philadelphia and Reading Railroad, for the Year ending November* 30, 1851.

Amount of Coal received from various Lateral Railroads in Coal Region.

Mount Carbon and Port Carbon Railroad, at Port Carbon, from Valley and Mill Creek Railroads,	500,365
Mount Carbon Railroad at Mount Carbon,	176,512
Mine Hill and Schuylkill Haven Railroad, at Schuylkill Haven,	699,885
Little Schuylkill Railroad at Port Clinton,	273,508
	1,650,270

Where delivered on Line of Reading Railroad.

Station or Turnout.	From Pt. Carbon.	From Mt. Carbon.	From Sch. Haven.	From Pt. Clinton.	Total.
Orwigsburg, . .	61	10	166	10	247
Port Clinton, . .	9				9
Hamburg, . . .	310	62	18	342	732
Mohrsville, . .	104	5		9	118
Between Morhsville and Reading, . .	1,056	257	72	199	1,584
Reading, . . .	15,516	3,254	21,936	585	41,291
Birdsboro' . .	743		410	291	1,444
Douglassville, . .	487	83	239	19	828
Pottstown, . .	6,055	146	1,253	293	7,747
Limerick, . . .	112	5			117
Royer's Ford, . .	479				479
Phœnixville, . .	5,348	109	1,937	26,148	33,542
Valley Forge, . .	1,155		509		1,664
Port Kennedy, . .	5,089	79	4,094	5	9,267
Norristown, . .	3,516		3,022	436	6,974
Furnaces and Lime-kilns below Norristown, .	8,163		770	2,763	11,696
Conshohocken, .	11,443	4,176	24,813	10,735	51,167
Spring Mill, . .	1,868	10	469	8,316	10,663
Manayunk, . .	652			320	972
Falls, . . .	4,653		9,088	13	13,754
Nicetown & Germantown,	1,959	362		2,271	4,592
Junction with State Road,	3,241	49	2,437	1,011	6,738
Philadelphia, . .	70,483	3,758	83,407	61,761	219,409
Richmond, . .	357,863	164,147	545,245	157,981	1,225,236
Totals,	500,365	176,512	699,885	273,508	1,650,270

TABLE, *Showing the Business of the Philadelphia and Reading Railroad* (*each item monthly*) *for the Year ending November* 30, 1851.

Date.	Travel.	Freight on Goods.	Freight on Coal.	U. S. Mail.	Miscella. Receipts.	Total.
December, 1850.	10,379·32	6,068·93	216,418·93	783·33	526·20	234,176·71
January, 1851.	10,421·62	16,086·47	168,839·99	783·33	930·71	197,062·12
February,	7,720·70	13,852·13	105,600·24	783·34	620·87	128,577·28
March,	10,312·21	9,530·76	135,873·67	783·33	896·88	157,396·85
April,	13,978·49	11,203·62	174,761·73	783·33	857·77	201,584·94
May,	14,296·67	10,448·71	164,484·89	783·34	609·01	190,622·62
June,	13,417·65	7,890·88	147,972·46	783·33	544·36	170,608·68
July,	16,115·98	8,346·50	154,396·88	783·33	598·57	180,241·26
August,	15,558·53	9,671·62	190,699·71	783·34	571·23	217,284·43
September,	14,692·99	10,620·54	186,565·80	783·33	618·88	213,281·54
October,	14,348·07	11,187·23	195,895·43	783·33	559·49	222,773·55
November,	11,189·41	8,764·95	177,361·06	783·34	2,621·66	200,720·42
Totals,	152,431·64	123,672·34	2,018,870·79	9,400·00	9,955·63	2,314,330·40

COAL TONNAGE.

December, 1850, . .	145,290 $\frac{3}{20}$	June, 1851, ...	129,526
January, 1851, . . .	114,077 $\frac{1}{20}$	July, ...	141,972 $\frac{10}{20}$
February, . . .	71,601	August, ...	173,717 $\frac{16}{20}$
March, ...	102,501 $\frac{6}{20}$	September, ...	165,730 $\frac{2}{20}$
April, ...	134,366 $\frac{6}{20}$	October, ...	178,821 $\frac{7}{20}$
May, ...	137,162 $\frac{2}{20}$	November, ...	155,504 $\frac{7}{20}$
		Total,	1,650,270

ANTHRACITE COAL TRADE OF THE UNITED STATES.

The following Table exhibits the quantity of Anthracite Coal sent to market from the different regions of Pennsylvania from the commencement of the Trade, in 1820, to 1851 inclusive; together with the Annual Increase, &c., and the Importations of Foreign Bituminous Coal.

Years	Schuylkill. Canal	Schuylkill. Railroad.	Schuylkill. Total.	Schuylkill. Pine-grove.	Schuylkill. Little Schuylkill.	Lehigh. Total	Other Regions. Lackawana.	Other Regions. Wilkes-barre.	Other Regions. Sham'kin	Other Regions. Lykens Valley.	Aggregate.	Annual increase.	Consumption.	Sold on line of Schuy'll	Import of foreign coal
1820	—	—	—	—	—	365	—	—	—	—	365	—	—	—	—
1821	—	—	—	—	—	1,073	—	—	—	—	1,073	—	—	—	22,122
1822	—	—	—	—	—	2,240	—	—	—	—	2,240	—	—	—	34,523
1823	—	—	—	—	—	5,823	—	—	—	—	5,823	—	—	—	30,433
1824	—	—	—	—	—	9,541	—	—	—	—	9,541	—	—	—	7,228
1825	6,500	—	6,500	—	—	28,393	—	—	—	—	34,893	25,352	—	—	25,645
1826	16,767	—	16,767	—	—	31,280	—	—	—	—	48,047	13,154	—	—	35,665
1827	31,360	—	31,360	—	—	32,074	—	—	—	—	63,434	15,837	—	—	40,257
1828	47,284	—	47,284	—	—	30,232	—	—	—	—	77,516	14,082	—	3,154	32,302
1829	79,973	—	79,973	—	—	25,110	7,000	—	—	—	112,083	34,567	—	3,832	45,393
1830	89,984	—	89,984	—	—	41,750	43,000	—	—	—	174,734	12,651	—	5,321	58,136
1831	81,854	—	81,854	—	—	40,966	54,000	—	—	—	176,820	2,086	177,000	6,150	36,509
1832	209,271	—	209,271	—	14,000	70,000	84,600	—	—	—	363,871	187,051	298,871	10,048	72,978
1833	252,971	—	252,971	—	40,000	123,000	111,777	—	—	—	487,748	123,877	434,986	13,429	92,432
1834	226,692	—	226,692	—	34,000	106,244	43,700	—	—	—	376,636	*decrease.*	415,186	19,429	71,626
1835	339,508	—	339,508	—	41,000	131,250	90,000	—	—	—	560,758	184,122	635,935	18,571	49,969
1836	432,045	—	432,045	—	35,000	148,211	103,861	—	—	—	682,428	121,670	632,428	17,863	108,432
1837	523,152	—	523,152	17,000	31,000	223,902	115,387	—	—	—	881,476	199,048	680,441	21,749	153,450
1838	433,875	—	433,875	13,000	13,000	213,615	78,207	—	—	—	739,293	*decrease.*	788,968	28,775	129,083
1839	412,608	—	412,608	20,639	9,000	221,025	122,300	—	11,930	—	819,327	80,034	867,000	30,390	181,551
1840	452,291	—	452,291	23,860	20,000	225,318	148,470	—	15,505	—	865,414	46,087	973,136	28,024	162,867
1841	584,692	850	584,692	17,053	40·000	143,037	192,270	—	21,463	—	958,899	93,485	958,890	41,223	155,394
1842	491,602	49,902	540,892	32,381	37,000	272,546	205,253	47,346	10,000	—	1,108,001	149,102	1,168,001	40,584	141,521
1843	447,058	230,254	677,205	22,905	31,000	267,793	227,605	58,000	10,000	—	1,263,539	155,538	1,263,539	34,619	41,163
1844	398,887	441,491	839,934	34,916	57,000	377,002	251,005	114,906	13,087	—	1,631,669	368,130	1,631,669	60,000	87,073
1845	263,587	820,237	1,083,796	47,928	74,000	429,453	273,435	178,401	10,000	—	2,023,052	391,383	2,023,052	90,000	85,776
1846	3,440	1,233,142	1,237,002	58,926	91,000	523,902	320,000	192,503	12,572	—	2,343,992	320,940	2,343,992	155,460	[illegible]

the *Discharge of Water over Weirs and Overfalls. By* Thomas Evans Blackwell, *M. Inst. C. E.**

ditional Observations, forming Columns 1, 9, *and* 10 *in the Original Tables, Kennet and Avon Canal.*

Continued from page 88.

Thickness of sheet of water taken at the outer edge of overfall plank, where there was a wide crest, at the outer end of such crest.

The 1st column is the total depth of water above crest, as given in tables.

The 2d column shows the height the water rose against a 2-ft rule held ways against stream.

The 3d column shows the height the water rose against the brass slide a rule held edgeways.

Table III.

Heighth above crest.	Flat Rule.	Edge Rule.
1	1	$\frac{5}{8}$
1	1	$\frac{5}{8}$
4	4	3
4	$4\frac{1}{4}$	$2\frac{11}{16}$
5	5	$3\frac{1}{2}$
5	5	$3\frac{1}{2}$
6	6	$4\frac{3}{8}$
6	6	$4\frac{3}{8}$
8		$6\frac{3}{8}$

Table IV.

Heighth above crest.	Flat Rule.	Edge Rule.
2	$1\frac{1}{4}$	
3	3	$1\frac{15}{16}$
4	5	$3\frac{1}{2}$
5		$3\frac{5}{9}$
6		$4\frac{3}{9}$
7	$5\frac{1}{8}$	
8	$6\frac{1}{8}$	
9	$6\frac{3}{4}$	

Table VII.

Heighth above crest.	Flat Rule.	Edge Rule.
1	$1\frac{1}{2}$	$\frac{1}{4}$
4	6	$1\frac{1}{2}$
6	8	1
7	9	$2\frac{3}{8}$

Table VIII.

Heighth above crest.	Flat Rule.	Edge Rule.
4	$5\frac{1}{2}$	$1\frac{3}{8}$
5	7	$1\frac{3}{4}$
7	8	$2\frac{1}{8}$

Table IX.

Heighth above crest.	Flat Rule.	Edge Rule.
$\frac{7}{8}$ to 1	$1\frac{1}{2}$	$\frac{6}{16}$
2	$3\frac{3}{4}$	$\frac{9}{16}$
2	$3\frac{1}{2}$	$\frac{9}{16}$
4	5	$1\frac{1}{2}$
6	$8\frac{1}{4}$	$2\frac{1}{4}$
8	9	$3\frac{1}{2}$

Table X.

Heighth above crest.	Flat Rule.	Edge Rule.
1	1	$\frac{7}{16}$
2	2	$\frac{7}{8}$
4	$4\frac{1}{2}$	$1\frac{3}{8}$
5	5	$2\frac{1}{4}$
6	6	$2\frac{1}{8}$
6	6	$2\frac{1}{8}$

Table XI.

Heighth above crest.	Flat Rule.	Edge Rule.
1 to $1\frac{1}{4}$	$1\frac{1}{8}$	$\frac{1}{2}$
3	3	$1\frac{1}{8}$
3	$2\frac{7}{8}$	$1\frac{1}{2}$
6	6	$2\frac{3}{4}$
9	$8\frac{1}{4}$	$4\frac{1}{8}$

Table XII.

Heighth above crest.	Flat Rule.	Edge Rule.
1	$\frac{7}{8}$	$\frac{7}{16}$
2	2	$\frac{7}{8}$
2	2	$\frac{13}{16}$
5	5	$1\frac{3}{4}$
6	6	$2\frac{5}{8}$
8	$7\frac{1}{2}$	$3\frac{5}{8}$
9	$8\frac{1}{2}$	$3\frac{1}{2}$
10	9	4

One of the general laws that appears to be indicated by these experi-

ments, is that in thin plates, the coefficient is highest at the smallest h observed, and that it reaches the mean, at a head of about 3 inches; a which it continues to decrease as the head increases.

For a plank 2 inches thick (which represents the ordinary form of wa board,) these experiments show, that beginning with a head of 1 in the coefficient is less than the mean; that it reaches its mean earlier, the length of the weir is greater, being in average cases at about the h of 3 inches; and that it then rises higher than its mean, till it reaches head of about 9 inches; when it is again depressed below the mean.

One remarkable circumstance was found to prevail in a great num of these experiments, viz., that the head of about 4 inches gave a l quantity than could be arrived at by interpolating the results of the periments with heads of 3 inches and 5 inches. It is not easy to expl the causes tending to produce this depression; but the fact was strik and well established.

A similar result occurred, at about the same head, in the other se experiments made at Chew Magna.

A few experiments, which were made for ascertaining the effect of c verging wing-walls, will demonstrate the great advantages known to attendant on such a form, as will be seen by comparing the results on weir of 10 feet in length with and without such wings. The mean efficients for the two cases were 371 without, and 459 with the win the splay of the wings being an angle of 54°.

The circumstance attending the set of experiments at Chew Ma makes the discharges of them analogous to the case of a weir in a riv or in a running stream; but among themselves there are anomalies equa remarkable with those on the canal. The overfall bar was here invar bly 2 inches thick, and the length was always 10 feet. The coefficien up to a head of 3 inches, are below the mean; above that head th fluctuate considerably; but generally they keep above the main li These anomalies are difficult to account for; the experiments having be very carefully made, and such causes of error as might have arisen not sufficient to explain them; they are therefore left as facts, to be add to, or elucidated, by the researches of others.

Appendix.

Table *showing the Variation of the Coefficients for different Species of Overfall.*

Species of Overfall.	Length in feet.	Mean Coefficients. m.	k.
Thin Plate, ...	3	·421	·080
"	10	·445	·086
Plank 2 inches wide, . .	3	·380	·073
" "	6	·377	·072
" "	10	.371	·072
" " (with wings,) .	10	·459	·090
Bar 2 inches wide, (Chew Magna,)	10	·480	
Crest 3 feet wide, slope 1 in 12, .	3	·338	·065
" " 1 in 18, .	3	·339	·065
" " " . .	10	·337	·065
" " Level, . .	3	·311	·060
" " " . .	6	·322	·061
" " " . .	10	·314	·061

Table showing the Variations of the Coefficients for different Heads of Water.

Number of Experiments, and Species of Overfalls.	Mean Coefficient (m,) applicable to Formula (I.)		Mean Coefficient (k,) applicable to Formula (II.)	
	Head in Inches.	Coeff't.	Head in Inches.	Coeff't.
6. Thin plate 3 feet long,	1 to 3 3 " 6	·440 ·402	1 to 2 3 " 6	·085 ·078
11. Thin plate 10 feet long,	1 " 3 3 " 6 6 " 9	·501 ·435 ·370	1 " 3 3 " 6 6 " 9	·096 ·086 ·072
23. Plank 2 inches thick, 3 feet long,	1 " 3 3 " 6 6 " 10	·342 ·384 ·406	1 " 3 3 " 6 6 " 10	·066 ·074 ·077
56. Plank 2 inches thick, 6 feet long,	1 " 3 3 " 6 6 " 9 9 " 14	·359 ·396 ·392 ·358	1 " 3 3 " 6 6 " 9 9 " 14	·069 ·077 ·074 ·069
40. Plank 2 inches thick, 10 feet long,	1 " 3 3 " 6 6 " 7 9 " 12	·346 ·397 ·374 ·356	1 " 3 3 " 6 6 " 7 9 " 12	·068 ·076 ·072 ·069
4. Plank 2 inches thick, (with wings,) 10 feet wide,	1 " 2 4 " 5	·476 ·442	1 " 2 4 " 5	·092 ·087
7. Overfall with crest 3 feet wide, sloping 1 in 12, 3 feet long,	1 " 3 3 " 6 6 " 9	·342 ·328 ·341	1 " 3 3 " 6 0 " 6	·066 ·063 ·066
9. Overfall with crest 3 feet wide, sloping 1 in 18, 3 feet long,	1 " 3 3 " 6 6 " 9	·362 ·315 ·332	1 " 3 3 " 6 6 " 9	·070 ·061 ·064
6. Overfall with crest 3 feet wide, sloping 1 in 18, 10 feet long,	1 " 4 4 " 8	·328 ·350	1 " 4 4 " 8	·063 ·068
14. Overfall with crest 3 feet wide, level, 6 feet long,	1 " 3 3 " 6 6 " 9	·305 ·311 ·318	1 " 3 3 " 6 6 " 9	·059 ·060 ·061
15. Overfall with crest 3 feet wide, level, 6 feet long,	3 " 7 7 " 12	·330 ·310	3 " 7 7 " 12	·062 ·060
12. Overfall with crest 3 feet wide, level, 10 feet long,	1 " 5 5 " 8 8 " 10	·306 ·327 ·313	1 " 5 5 " 8 8 " 10	·059 ·063 ·061
61. Chew Magna. Overfall bar, 2 inches thick, 10 feet long,	1 " 3 3 " 6 6 " 9	·437 ·499 ·505		

Mr. Blackwell, having explained the tables and the diagrams illustrating the paper, stated that his object in bringing the subject before the Institution had been, to make known certain recorded facts; and he conceived that from these experiments some useful deductions might be drawn, which he trusted would induce other members to make similar investigations.

Mr. Simpson said, the experiments at Chew Magna were undertaken to settle a question, as to the discharge from some reservoirs connected with the Bristol waterworks. These were always kept to a nearly uniform level; but as the water was discharged by a sluice, 19 feet in height, at the rate of about 4 feet per second, there was a slight agitation of the water in the reservoir which would account for some of the anomalies in

the experiments alluded to by Mr. Blackwell. On the whole, he did not think these anomalies were greater than was met with in similar cases, when the country was precipitous, and the water was delivered from a high reservoir into a still pool, and then gauged through notch boards. The Wynford brook, on which the reservoir at Chew Magna was situated, fell about 90 feet in a mile, and floods had been recorded which discharged seventy times the ordinary flow of water. The experiments had been carefully made, and gave, he believed, correct results in all cases.

Mr. J. Scott Russell thought Mr. Blackwell's experiments had been conducted in a most useful manner, and on a sufficiently large scale to be applicable to general practice; and he would rank them higher, and considered them more trustworthy, than those made by Du Buat and D'Aubuisson; as those made by Du Buat, though on a large scale, were far from the truth, and those by D'Aubuisson, though better in character, were made on too small a scale to be of practical utility. As far as he had been able to understand Mr. Blackwell's formula, nothing more was meant by it than the nearest approach to a general law, and the difference between it and each practical experiment being ascertained, showed how much the coefficient required to be altered so that the formula and the experiment might coincide. Then the mean of the coefficients of that class of experiments might be taken as a general coefficient for that class, and the difference between it and the coefficient in each experiment would be the measure of discrepancy between the two. The experiments differed so considerably from one another, that the method adopted was the only rational one; because if they took any isolated experiment, and put it down as a fact to be followed in other cases, it would lead to erroneous conclusions. He believed, therefore, the mean of the coefficient was the only thing which would represent the truth, so far as it resulted from experiment. The first table exhibited seemed to him to show, not so much the law of overflow, as the deviations from the supposed law; whilst the diagram appeared to show the law which the delivery followed, as determined by the height of head, under different circumstances of breadth of overfall. And the two together conveyed to his mind a very simple and clear view of the results of all the experiments which had been compared together, so that in order to apply these results to practice, it was only necessary to take the height of head, as given in that table, and the quantity discharged by a unit of breadth, and then to judge which of these most nearly approached the case under consideration. With regard to the discrepancies, which had been noticed by Mr. Blackwell, in the Chew Magna experiments, he believed they might be attributed to the variations of the velocity, caused by the current of the stream entering the reservoir; for he had himself seen, in a reservoir 120 feet wide, that a small stream running into it with a velocity of 4 feet per second, caused the water in the reservoir to be disturbed for a distance of 100 feeet; indeed, formed a distinct current for that distance. This proved how necessary it was to notice every minute fact when recording each observation. It would be a great boon to the profession, if the members of the Institution would make a point of transmitting the results of experiments on any question; and it was exactly that kind of contribution which the younger members could make with so much certainty, and with so much advantage to themselves and the profession; for whilst, on the

hand, the collection of well authenticated facts induced a habit of ate research; on the other hand, it brought to the older and more ienced members, the means of drawing general conclusions, and of cing correct rules from actual experiments.

. Hawksley coincided with the expression of the general value of sults of the experiments, as a record of observed facts. He thought, ver, that these experiments had been made under such widely dif- circumstances, that they would not be available for the determina- f a satisfactory formula. He had also made a considerable number periments, to determine the value of the coefficient to be used with dinary formula, for measuring the flow of water over a "notch-board." experiments were made on a brook, in which six gauge boards fixed, having notches, edged with iron, and of different widths and s. The velocity of the current in the pond, above each notch, was ed as much as possible, and the water discharged, after passing ssively over all the boards, was at last accurately weighed, by a ine constructed for the purpose. Each notch of necessity discharged me quantity of water in the same time; consequently, if the formula oyed by Mr. Hawksley was correct, it must necessarily give the result over all the differently formed notches, and finally coincide the determination of the quantity by the process of weighing. This o nearly the fact, that the maximum error did not exceed one-six- 1 part of the whole. On some future occasion he would take an tunity of placing these and other hydraulic investigations, before embers of the Institution.

. Cawley believed, that if the diagrams exhibited by Mr. Blackwell carefully studied, the discrepancies, which at first sight seemed to would vanish, and they would be found to be attributable, almost ably, to friction. Where the water passed over a thin plate, there omparatively little or no friction at the sides, and therefore the co- nt would accurately represent the discharge for every width of ll; but when the height of the head of water was greater, or the over- d wings, the case was different, as then there would be a consider- mount of friction, varying, of course, with different circumstances.

. S. Ballard stated, that in September, 1836, he had made a series periments, for Mr. T. Rhodes, on the flow of water over weirs, on the Severn, at Powick, near Worcester. These experiments were made a weir 2 feet long, formed by a board standing perpendicularly a trough. The results are given in the following table:—

Depth of Water flowing over the Weir, in inches.	Cubic Feet per Minute over 1 foot of Weir.	Depth of Water flowing over the Weir, in inches.	Cubic Feet per Minute over 1 foot of Weir.
1	5·88	4	46·87
1¼	7·14	4¼	49·45
1½	9·55	4½	54·87
1¾	12·37	4¾	59·60
2	14·93	5	63·38
2¼	18·29	5¼	66·17
2½	23·07	5½	73·17
2¾	27·69	5¾	77·58
3	32·14	6	82·56
3¼	34·61	7	102·27
3½	37·81	8	126·76
3¾	41·47		

the commencement of these experiments, satisfactory results could

not be obtained, on account of the difficulty of observing the exact depth of water on the weir, for a gauge, which had been set up at the side, did not clearly show the height, owing to the capillary attraction. The method then adopted was to attach two needles to the lower end of an accurately graduated gauge, one of which was a very little longer than the other, so that on the water being admitted by a sluice regulated by a screw, its level was adjusted until it just touched the longest needle, and occasionally, by its uneven motions, the shortest needle, and thus the exact height of the water above the weir was observed. The water, after passing over the weir, fell into a square tank, capable of holding 300 cubic feet, in which a gauge, graduated so as to show every 10 feet of water, was fixed. This gauge had a floating guard around it for keeping the water still, so that the exact height could be taken; and for the purpose of showing clearly when the water arrived at each 10 feet mark, a pin was placed at right angles to the gauge, and the instant the water touched, it was immediately seen. As it was thought that the perpendicular position of the board forming the weir might have some effect in diminishing the quantity of water passing over it, a sloping board, inclining on the upper side, from the top of the weir downwards, was substituted, when the quantity of water discharged was increased, with 1 inch depth of water, from 5·88 cubic feet per minute to 6·76 cubic feet per minute; or about 15 per cent. Experiments were subsequently made with a weir of only one foot long, when the quantity of water discharged was less, in proportion, than it was with the 2 feet weirs. This was attributed to the contracted stream caused by the direction of the course of the water at the sides of the weir. Experiments were also tried with oblique weirs, and circular weirs, and the result was, that the quantity of water discharged was in proportion to the length of the weir.

Extract from the Report to the Secretary of the Treasury on Light-Houses of the United States.

The Board, after examining, with a patience and a zeal which they believe this important branch of the public service to demand, the different points to which their attention was specially called by the instructions of the Department, have arrived at the following conclusions, which they feel assured will be found to be fully sustained by the detailed data in this report, and its appendix, upon which they are chiefly based:

1. That the light-houses, light-vessels, beacons, and buoys, and their accessories in the United States, are not as efficient as the interests of commerce, navigation, and humanity demand; and that they do not compare favorably with similar aids to navigation in Europe in general, but especially with those of France and Great Britain, and their dependencies.

That the light-house establishment of the United States does not compare favorably in economy with those of Great Britain and France.

That, while the superiority of the European lights to those of the United States, (arising from the greater care and attention bestowed upon them, the better and more expensive apparatus employed in them, the larger number of keepers to the lights, the more rigid superintendence

and frequent visitations for inspections and for delivery of supplies,) renders any just comparison of them in annual expense in money impossible; it is shown that the difference for maintenance per lamp per annum is very small, and that not invariably in favor of those of this country.

That the towers and buildings have not been constructed in general of the best materials, nor under the care and supervision of competent or faithful engineers.

That the want of professional knowledge of the materials, mortars, cements, &c., &c., for construction and repairs, or faithfulness on the part of those charged with the duty, was apparent in nearly all the modern towers and buildings visited by the Board.

That the present large sums annually required for renewing, renovating, and repairing towers and buildings, are the consequences of the want of an efficient organization, which could afford the necessary professional ability for plans, drawings, and superintending of constructions and repairs.

That the towers are deficient in the necessary proper accommodations for oil and other supplies; in the mode of fitting them up, and in the materials employed for the interior work; and the buildings ill adapted to the comfortable accommodation of the keepers.

That the lanterns are, as a general rule, of improper dimensions, constructed of ill-adapted, and, in the end, not economical materials, without professional or scientific skill; and, in many instances, not suited to the use for which they are designed.

That there is no proper system of ventilation for lanterns.

That the means said to be employed for ventilating are wholly inadequate, and contrary to true scientific principles.

That there is very little attention paid to the painting of the interior of the lanterns and astragals, and in glazing.

That, under a well organized system, the lights and other aids to navigation might be greatly increased in number and efficiency, at a large saving upon the present annual cost.

That there has never been an efficient systematic plan of construction, illumination, inspection, and superintendence of lights, &c., &c., in the United States.

That towers and buildings have been constructed without regard to the wants of the service, and to the peculiarites of localities, and the special design of the lights themselves.

That the light-house towers, buildings, and vessels visited by the Board were not, in general, found to be in a creditable state of preservation and repair.

That the inferiority of illuminating apparatus in the light-houses of the United States renders its renewal frequently necessary, at great expense, and never produces as effective a light as it is capable of making.

That the reflector apparatus employed in the light-houses of the United States is greatly inferior to the requirements of the service, being defective in form, materials, and finish.

That the illuminating apparatus in the United States is of a description now nearly obsolete throughout all maritime countries, where the best

apparatus of that description was employed, prior to the introduction of the Fresnel lenses, as substitutes.

That the sea-coast reflector lights are, in general, too low, and are deficient in power and range.

That our sea-coast reflector lights are not fitted with a sufficent number of lamps and reflectors to produce the greatest amount of usefulness, which the imperfect system of lighting with the reflectors will produce.

That the lamps and reflectors are not, as a general rule, properly placed on the frames, due regard not being paid to divergency.

That the sea-coast lights are deficient in proper attendance, with only one keeper.

That there is no proper classification of lights in the United States.

That the lights are not properly and sufficiently well distinguished along the coast of the United States.

That there is no system of public inspection and superintendence, calculated to render the light-house establishment moderately useful or efficient.

That the lanterns, illuminating apparatus, &c., are not superintended, while they are being made, by competent or faithful professional men.

That there are no general or special regulations for keepers and others connected with light-houses, by which to insure an intelligent or faithful performance of the duties.

That supplies of all kinds, involving the good or bad quality of the lights to a great extent, are not tested and selected by competent persons before issuing them to light keepers.

That there is not a proper degree of responsibility on the part of the agents connected with the light-house establishment.

That the present mode of procuring and distributing supplies, apparatus, &c., is not calculated to insure either efficiency or economy in the service.

That contractors are not held under a sufficiently rigid superintendence and inspection during the execution of works of construction and repair.

That the modern light-house towers are inferior in point of materials and workmanship to the older ones visited by the Board; such, for example, as Sandy Hook light-house, built in 1762; Cape Henlopen tower, built in 1764; Cape Henry tower, built in 1791.

That the floating lights of the United States are comparatively useless, for want of efficient lamps and parabolic reflectors.

That the light vessels are in general not adapted to the service they are required to perform, being defective in size, model, and moorings.

That the light vessels are not properly distinguished either by day or by night.

That sufficient regard has not been had to the proposed use of the several lights, so as to regulate their power and range accordingly.

That there is no effective system by which to afford to sparsely settled parts of the coasts requiring lights, the means of bringing the subject before Congress, and of deciding in advance of appropriations the best descriptions of lights to be placed at the desired points.

That many of the small lights have an unnecessary number of lamps and reflectors, while sea-coast lights are greatly deficient in them.

That in the form and adjustment of the reflectors, sufficient attention is not paid to the range and other circumstances of the required lights, involving scientific principles.

That there is not, in useful effect, a single first class light on the coast of the United States.

That the lights at Navesink (two lenses), and the second order lens light at Sankaty Head, Nantucket, are the best lights on the coast of the United States.

That there are very few, if any, reflector lights on the coasts of the United States better in useful effect than the third order lens light (larger model) erected by the Topographical bureau on Brandywine shoal, while the economy of the lens light is in the ratio of at least 4 to 1.

That the lens lights at Navesink, Sankaty Head, and Brandywine shoal are considered to be, as a general rule, equal to European lights of the same classes.

That the Fresnel lens is greatly superior to any other mode of light-house illumination, and in point of economy is nearly four times as advantageous as the best system of reflectors and Argand lamps.

That the buoys in the waters of the United States are defective in size, shape, and distinction, as a general rule; and that sufficient care is not taken, nor competent persons employed, to place, moor, and replace them.

That the moorings of buoys are not sufficiently heavy, and the chains not properly tested as to size and strength.

That the sea-coast lights along the southern coast from the highlands of Navesink, are comparatively useless to the mariner for want of sufficient power and range.

That the dangerous obstructions to navigation around Cape Florida, from the Gulf of Mexico, are not properly lighted and otherwise marked to aid navigators.

That the entire southern coast of the United States requires additional lights and other aids to navigation, to render human life and property safe.

That, for want of an efficient organization, there is no systematic plan adopted on any part of the coast of the United States for rendering navigation safe and easy by means of lights, beacons, buoys, &c., &c.

That lights and other aids to navigation are provided, as a general rule, through the action of Congress upon petitions emanating from persons having a local interest, or from boards of pilots, insurance offices, chambers of commerce, &c., &c.

That under a proper organization, the officers of the light-house establishment would collect information from reliable sources, decide upon the doubtful points, and recommend to Congress all cases of sufficient importance to warrant appropriations.

That the approaches to some of our principal and most important harbors, bays, &c., are not sufficiently lighted and marked to render steam navigation as rapid, easy, and safe, as the wants of commerce demand, especially to New York, Delaware, and Chesapeake bays, and some of their tributaries.

That the duty of lighting and marking with beacons, buoys, and sea-marks, our extended sea, lake, gulf, bay, sound, and river coast, efficiently

and economically, can only be performed by persons of professional experience and undoubted ability upon a systematic plan, based upon the principles of the most approved light-house engineering.

That there is no efficient system of inspection and superintendence of lights in the United States.

That the light-keepers, in many cases, are not competent, and in no instances have they been instructed in reference to their duties, nor examined to ascertain their ability to perform the duties faithfully.

That the supplies of oil, chimneys, wicks, &c., &c., are not tested and selected with sufficient care, or by competent or faithful agents.

That there is no proper system of distributing the supplies to light keepers.

That proper attention is not given to purchasing and distributing supplies.

That the cleaning powder used in our light-houses is injurious to the reflectors, and not such as is used in other light-house establishments; and other articles are equally defective.

That there is no system in the management of the light-house establishment of the United States.

That the instructions to light-keepers to light, trim, and extinguish the lights at certain specified times are not enforced, to the detriment of the service, and to the imminent risk of endangering vessels in their vicinity.

That such knowledge is not imparted to light-keepers, as a general rule, to enable them to keep their lamps, burners, reflectors, and lanterns in such order as to insure the best lights from the existing apparatus.

That frequent and rigid inspections and superintendence by competent persons are necessary to insure an efficient and economical light-house service.

That competent keepers, responsible to the Government through inspectors, are indispensable to insure good lights at all times.

That supplies are not delivered at sufficiently short intervals of time to the lights.

That the present mode of repairing illuminating apparatus, oil tanks, &c., &c., is not economical, efficient, or reliable.

That the removal and replacing of light vessels, the extinguishment or lighting of lights, removal or placing of buoys, &c., or in any manner changing lights and other aids to navigation, without giving ample notice, are subjects of grave complaints.

That there is no good reason why the light vessels on the coasts of the United States (if properly constructed and moored) should not remain at their moorings under as unfavorable circumstances as those on the coasts of England and Ireland.

That whenever light vessels are reported to have parted their moorings, the circumstances attending them should be carefully investigated by competent and disinterested persons, and the result made known.

That the erection of light-house towers of a uniform height, without regard to the elevation of the land upon which they are placed, is contrary to the first principles of light-house engineering, involving, in situations of great natural elevations above the level of the sea, unnecessary

expense, and on low coasts the inefficiency of the light for want of sufficient range.

That due regard has not been had to the wants of commerce in selecting sites for lights along the coasts of the United States.

That for want of a proper system in this branch of the public service, the densely populated coasts have a superabundance of lights, to the injury of navigation, while on the sparsely settled coasts, bounding the great outlet to the millions of commerce from the valley of the Mississippi and its tributaries for hundreds of miles, there is not a single light.

That light-house construction, illumination, inspection, and superintendence, involve a large amount of special and general professional knowledge of a high character, and therefore should only be entrusted to the most competent professional persons.

That competent engineers have not been employed, except in a few instances, to plan and superintend the construction and fitting up of the light-houses of the United States.

That the large amounts required annually to repair and keep in good order the towers, buildings, vessels, and illuminating apparatus of the lights in the United States, is attributable to the manner in which the work was executed, and to the inferiority of the materials employed.

That large sums are now required to preserve foundations of light-towers, sea-walls, &c., which might have been saved by the adoption, by competent engineers, of proper plans and foundations for them.

That no systematical and economical plan of construction has been employed in the light-house establishment.

That changes are constantly taking place in the aids to navigation, without any official notice being given to the public of them, which are calculated to mislead mariners.

That there is no proper system of beaconage and buoyage, nor any list of them, by which the navigator, who is not familiar with the coast, can derive any benefit.

That the list of light-houses and light-vessels is defective in many respects; and it, at present, affords very little information to the navigator, and is, in some respects, erroneous.

That there is no regular systematic or effective mode of giving notice to mariners of proposed changes in lights, &c., &c., or of any that may have been destroyed or removed by the action of the sea or winds.

That the buoys are not properly painted according to law, nor are they in other respects properly distinguished one from another.

That light-houses and light-vessels are not sufficiently well distinguished by day.

That the buoys are not properly placed, nor replaced when driven from their positions, and without delay.

That buoys are not placed upon new shoals, over wrecks, &c., except by a special act of Congress, through the agency of some philanthropic or interested person.

That spare buoys are essential for all harbors and rivers in sufficient numbers to allow for all casualties, and for cleaning, painting, &c., &c.

That there is no code or manual of instructions to guide light keepers and others connected with the light-house service, in the performance of

their duties in this country, as is found in every well regulated light-house establishment elsewhere.

That there is no meteorological reason for the lights of the United States being worse than those of equal class and importance in England and France.

That there are no proper books of daily expenditure kept; no returns of daily expenditure made of a reliable character; and the lights are deficient in all the essentials for the faithful performance of this duty, such as books, forms, registers, &c., &c.

That light keepers should be required to devote all their time to the care of the lights under their charge, and should not be allowed to attend to their ordinary affairs, to the injury of the service.

That if all our present lights were fitted with lens apparatus of equal power to the reflectors now in use, the annual expense for supplies of oil and cleaning materials would cost little more than one-fourth as much as is now expended for these articles of supply annually; that is, that the supplies now costing upwards of $152,000, would not exceed $38,000 to $42,000, making an annual saving of $110,000 to $115,000.

That in addition to the greater superiority in brilliancy, power, and economy of the lenses, compared to the reflectors, they possess the great advantage of durability, to the extent of never requiring to be renewed.

The Board therefore recommend:

That the general programme for improving the sea-coast lights of the United States, and of making necessary additions, be adopted as the basis of future recommendation and legislation.

That the Fresnel or lens system modified in special cases by the holophotal apparatus of Mr. Thomas Stevenson, be adopted as the illuminating apparatus for the lights of the United States, to embrace all new lights now or hereafter authorized, and all lights requiring to be renovated either by reason of deficient power or of defective apparatus.

To be Continued.

---

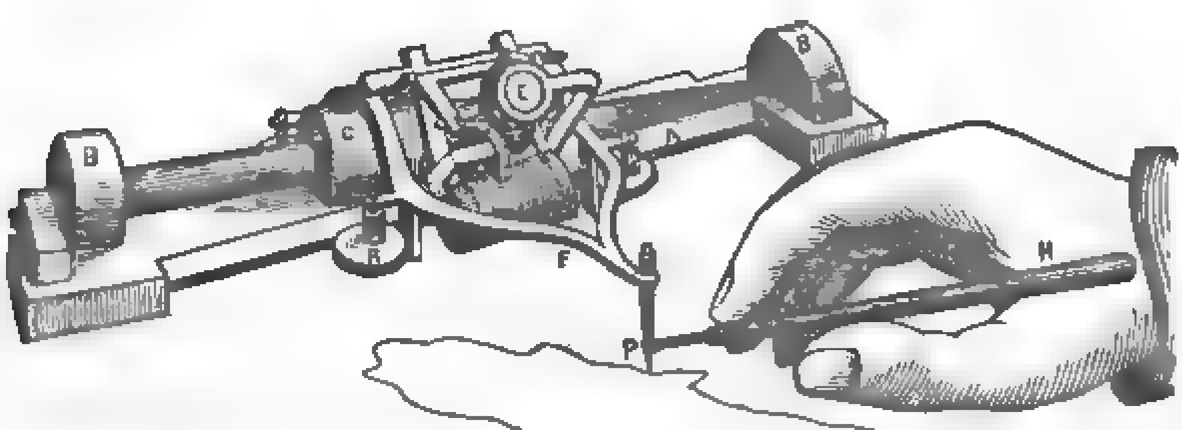
*Description of Sang's Platometer, or Self-Acting Calculator of Surface.**

The usual method of discovering the area of a figure drawn on a plan is, to divide it into a number of triangles or trapeziums—to measure the base and altitude of each, and take the sum of their products. By a careful process of this kind, the area may be discovered with great accuracy; but as it is necessary to revise the calculations several times, both for the purpose of obviating faults in the arithmetical part of the work, and in order, by taking the average of a few independent measurements, to increase the probable accuracy of the result, this method of calculation, especially when the figure is irregular, entails a considerable amount of labor of an irksome kind. Attempts have been made to avoid this by cutting the figure from the sheet of paper, and weighing it in a delicate balance against weights consisting of parts of the same paper, of determinate sizes; but this method, at first sight simple and practical, is rendered of little use by the impossibility of obtaining paper of uniform

* From the Glasgow Practical Mechanic's Journal, December, 1851.

thickness throughout the sheet, the variation of thickness, and hence of weight, being greater than the amount of error that could be allowed in the results.

The instrument invented by Mr. Sang, of Kirkaldy, represented in our perspective figure, indicates the area of any figure, however irregular, on merely carrying the point of a tracer round its boundary, and, besides the advantage of not injuring the drawing, it possesses that of speed and accuracy. A frame, A, carries an axle, which has on it two rollers, B, of equal size, and a cone, C. It is heavy, so that it maintains its parallelism on being pushed along the paper. The sides of the frame are parallel to the edge of the cone, and are fitted to receive the circumference of four friction rollers, R, which move along A, and carry a light frame, F, terminating on the tracing-point, P, to which the handle, H, is attached by a universal joint. The frame, F, also carries a wheel, I, which, by means of a weight, is pressed on the surface of the cone, and receives motion from it as the tracer is carried along the paper. The index-wheel, I, only touches the cone by a narrow edge, the rest of its circumference being of smaller diameter, and containing a silver ring divided into 200 parts, which are again subdivided by a vernier into 2000 parts. The value of each of these divisions is the $\frac{1}{100}$th part of a square inch; so that one turn of the wheel represents 20 inches. Another index-wheel, T, moved by I, is divided into five parts, each of which represents 20 inches, so that a complete revolution of T values 100 inches. The eye-glass, E, assists in reading the divisions and vernier.



It is apparent, from the construction of this instrument, that if the tracer be moved forward, it will cause the index to revolve, not simply in proportion to that motion, but in proportion to the motion of the tracer multiplied by the distance of the edge of the index-wheel from the apex of the cone; and that the revolving motion of the index-wheel will be positive or negative, according as the tracer is carried backwards or forwards. Hence, if the tracer be carried completely round the outline of any figure, on arriving at the end of its journey, the index-wheel will show the algebraic sum of the breadth of the figure at every point, multiplied by the increment of the distance of the points from the apex of the cone; that is to say, the area of the figure.

This instrument possesses great simplicity of construction. Both factors of the continuous multiplication are directly transmitted from the motion of the tracing point in the simplest manner. The influence of the elasticity

of the parts of the machine on the accuracy of its indications, may be discovered by moving the tracer a second time over the boundary of the figure, after having turned the whole instrument round 180°. The effects of the imperfections in the mechanism will now have changed signs, and one of the results will probably be found to be a little too large, and the other a little too small. The average between the two is the exact area of the figure, and is more to be depended on than the results of measurements made by scale and calculation in the usual way. A careful operator, in using the platometer, will always take the average of two tracings in this manner; but when he experiences the rapidity with which this may be done, he will find the trouble as nothing in comparison with the harassing labor of calculating by scale and multiplication.

Rules for Solid Mensuration. *By* Ellwood Morris, *Civil Engineer.*

The following letter, addressed to a member of the Institute, is published with the consent of the writer. It presents to our readers a very interesting generalization, and it is hoped that Mr. Morris may soon favor us with a theoretical demonstration of his application of the prismoidal rule.

Dear Sir:—In the course of my practice as a Civil Engineer, the frequent occasion I have had for the employment of the ordinary rules of *solid mensuration*, naturally drew my attention to their redundancy as laid down in the books, for the solution of particular cases; and some years ago, in several papers published in the *Journal of the Franklin Institute*, on the application of the "*prismoidal formula*" to the mensuration of excavation and embankment, I pointed out the fact, that this formula is *the fundamental rule for the mensuration of solids;* and that the rules of the books are merely particular cases, in which, by the elimination of certain terms, fewer figures are required.

Reflecting then upon the immense mass of matter necessary to be committed to memory by the modern scholar, it occurred to me, that it would be much better to teach this rule alone in the schools, than to burden the pupils' minds unnecessarily with a host of special rules, which are in fact particular cases of the "*prismoidal formula,*" though none of the works on mensuration have ever pointed out their connexion and dependency.

Not having time to develope this matter so fully in scientific language, as to command the attention of the mathematicians of the country, and failing then to enlist the interest of those to whom I mentioned it, I had dismissed the subject from my mind, until recalled to it incidentally by a recent conversation with yourself.

Busied at the present moment in preparations to take the field upon an important professional service, I have only time to call your attention to a number of leading rules of solid mensuration, which are superseded by the "*prismoidal formula;*" a formula in itself so simple, that it may be committed to memory in five minutes' time, by any child of ordinary capability.

The leading rules of solid mensuration laid down in the books, separate rules being given for each solid, are the following, every one of which may be superseded by the "*prismoidal formula.*"

1. To find the solidity of a Cube.
2. " " Parallelopipedon.
3. " " Cylinders and Prisms.
4. " " Cones and Pyramids.
5. " " Frustum of Cone.
6. " " Frustum of Pyramid.
7. " " Wedge.
8. " " Prismoid.
9. " " Sphere.

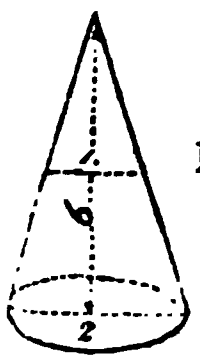
A number of other special rules are given for the solidity of spheroids, paraboloids, and other solids of revolution, their spindles and segments; to many of which our formula is also applicable; but for the purposes of this communication, it may be sufficient to show, by actual figures, working out examples of the most unpromising cases, the applicability of the "*prismoidal formula*" to compute the solidity of *a cone*, *a wedge*, *a sphere*, and *a hemisphere*. I may here mention, that its accurate application to spheres and spheroids (solids of curved surface) has excited the surprise of many mathematicians, who were prepared to admit its fitness for the mensuration of right lined or plane bounded solids.

By the Special Rules of the Books.

To find the solidity of a Cone.

Rule.—Multiply the area of the base by the height, and one-third of the product will be the solidity.

Given.—A cone having a diameter at the base of 2, and a height of 6. Query: The *solidity?*



$2 \times 2 \times \cdot 7854 = 3 \cdot 1416$

Mid. diam. $= 1$. $\quad 6$

$3)\overline{18 \cdot 8496}$

Solidity $= 6 \cdot 2832$

By Prismoidal Formula.

The Prismoidal Formula is,—Add into one sum the areas of the two ends, and four times the middle section parallel to them; then this sum multiplied by one-sixth of the height will give the solidity.

In the case of the cone opposite, the diameter of the base being 2, and of the mid section 1, we have, by the prismoidal formula,

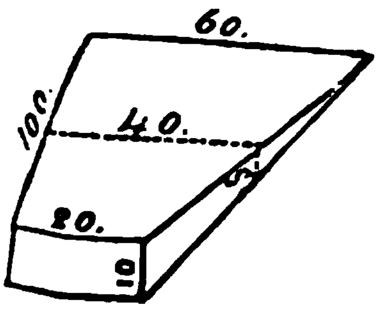
Base,	$2 \times 2 \times \cdot 7854$	$= 3 \cdot 1416$
4 times mid sec.	$1 \times 1 \times \cdot 7854 \times 4$	$= 3 \cdot 1416$
Top		$= 0 \cdot$
	$\frac{6}{6} = \frac{1}{6}$ ht.	$= 1 \cdot \times 6 \cdot 2832$
Solidity,	. .	$= 6 \cdot 2832$

To find the solidity of a Wedge.

Rule.—To the length of the edge, add twice the length of the back; multiply this sum by the height of the wedge, and then by the breadth of the back: one-sixth of the product will be the solidity.

Given.—A wedge; length of edge 60, back length $= 20$, back breadth $= 10$, height 100. Query: *Solidity?*

Length of edge,	.	$= 60 \cdot$
Twice back,	$20 \times 2 =$	$40.$
		$100.$
		100
		$10{,}000$
		10
		$6)100{,}000$
	Solidity $=$	$16{,}666\frac{2}{3}$



Wedge—Solidity by prismoidal formula.

Area of base,	.	$20 \times 10 = 200$
Four times mid sec.		$40 \times 5 \times 4 = 800$
Top,	. .	$= 0$
	$\frac{100}{6} = 16\frac{2}{3} \times$	1000
Solidity,	.	$= 16{,}666\frac{2}{3}$

We will now take the case of a sphere, to which nearly all mathematicians have at first sight denied the applicability of the "*prismoidal formula.*"

By Special Rules.

To find the solidity of a Sphere.

RULE.—Multiply the cube of the diameter by decimal ·5236, the product will be the solidity.

Given.—A sphere of a diameter or axis in length =12. Query: The solidity? Then

12×12×12×·5236 =904·7808 solidity.

By Prismoidal Formula.

Solidity of the Sphere opposite.

Top	= 0
Four times mid sec. 12×12×·7854×4	=452·390
Base	= 0
	452·390
$\frac{1}{6}$ ht. $= \frac{12}{6}$	=
Solidity	=904·780

Solidity of a Hemisphere.

Take the same dimensions as in the sphere above, and we have—

	2)904·78
Solidity of hemisphere	=452·39

Solidity of a Hemisphere.

Diameter of mid section	= 10·39
Diameter of base	= 12
Height or radius	= 6

Then by Prismoidal Formula—

Area of base	=113·097
Four times mid sec. 10·392×10·392×·7854×4	=339·272
Top	= 0
	452·369
$\frac{1}{6}$ ht. $= \frac{6}{1}$	
Solidity	452·369

The difference in the last decimals is owing to too few decimal places having been used in the computation.

For the sake of illustration, it is not necessary to go any further, and I think you will, on examination, admit that the "*prismoidal formula*" possesses some curious and useful properties; and that its adoption in the schools in teaching solid mensuration, would alleviate materially the tasks of the scholar.

Pittsburg, February 7, 1852.

AMERICAN PATENTS.

List of American Patents which issued from February 10*th to* 24*th*, 1852, (*inclusive,*) *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

15. For an *Improvement in Shoe Brushes;* John Jay Adams, Boston, Massachusetts, February 10.

Claim.—"I therefore claim as my invention, the brush as constructed substantially as represented in figure 2, and as above described; that is to say, with its polishing and *blacking bristles* arranged essentially as exhibited in the said figure and as above explained."

16. For an *Improvement in Watch-Chain Swivels;* Samuel Y. D. Arrowsmith, City of New York, February 10.

"The nature of my invention consists in the construction of a swivel with the rotating parts concealed, and with but one spring to operate on both ends, which spring passes through the entire centre of the shaft."

Claim.—"What I claim as my invention is, 1st, the making swivels with a central spring to operate at both its ends against the knuckles of the joints, and for closing the opening, substantially as described.

"2d, In combination with the swivel so made, I claim the swivel joint made substantially as described."

---

17. For *Hose Coupling;* Albigence W. Cary, Brockport, New York, February 10.

"The nature of my invention consists in providing a spring, clasp, or band, of any suitable material, of such a form, that a part of one or both ends shall extend beyond the place of fastening, the object of such extension being to secure the uninterrupted pressure or contracting force of the clasp around the entire circumference of an inserted tube, and thus form a joint which shall be perfectly water tight under any hydraulic force which the hose shall sustain."

Claim.—"I do not claim as my invention, the clasp in its general form, or as made to spring and used with a screw; I claim the clasp of the particular form above described, having a part of one or both ends extended beyond both places of fastening, so as to extend the contracting pressure directly around the entire circumference of an inserted tube, which extension I claim as a new and useful improvement on all clasps or bands used for coupling hose, with which I am acquainted."

---

18. For an *Improvement in Horse Powers;* M. H. Cornell, Feasterville, Pennsylvania, February 10.

Claim.—"Having thus described my improved horse power, what I claim therein as especially new is, the method of regulating the motion by means of a brake worked by a governor constructed substantially as herein described, so as to operate the brake with a force which increases with the velocity of the machine, until the motion is checked, and then instantly release the brake, so that no unnecessary labor may be imposed upon the animals, when working at the proper speed."

---

19. For an *Improvement in Mills for Grinding Quartz;* Smith Cram, City of New York, February 10.

"My quartz crusher and grinder consists mainly of a horizontal annular trough, and of two vertical crushing wheels, which are caused to rotate in the trough, and at the same time to revolve around a central axis."

Claim.—"What I claim as my invention is, the crushing and grinding mill herein described, consisting of a trough and one or more rotating wheels, the acting surfaces of both the wheels and trough being formed as herein set forth, so that the former will run in the latter, without tendency to run over its edges, except as it may be influenced by centrifugal force.

"I also claim the combination of a double ridged wheel rim with a trough of corresponding form, whereby the lumps of quartz, or other substance being ground, are grasped by the wheel in its rolling between the angular groove or furrow contained between the two ridges, and being thus prevented from escaping laterally, are crushed upon the ridge of the trough with much less force and greater effect than if the angular action of the ridges was counteracted by the embedding of the lumps to be crushed, among smaller granular and pulverized particles, which is always the case when the concave or inner angle is below, and the convex or outer angle above, which is the converse of the combination to which this claim refers.

"I likewise claim the method of constructing the wheels of a crushing and grinding mill, of removable sections, substantially in the manner and for the purpose herein set forth."

20. For an *Improved Mode of Preventing Collisions on Railroads;* Thomas A. Davies, City of New York, February 10.

"The nature of my invention consists in applying to a locomotive engine, a sound gatherer with an ear piece, in such a manner that any extraordinary noise made by the approach of a train, or by a steam whistle, or any known way of making a great noise, is gathered and communicated to the ear of the engineer, in time to stop his engine, or train, as the case may be."

Claim.—"What I claim as new and original is, the application of a sound gatherer with an ear piece, to a locomotive engine, or train of cars, arranged substantially as above described, so that the engineer or another can ascertain by sound, the approach of a locomotive or train, in time to prevent collision."

---

21. For an *Improvement in Grain Harvesters;* Byron Densmore, Sweden, New York, February 10.

"My invention and improvements consist in a new arrangement for raking the grain from the machine; likewise in a new arrangement for raising and lowering the machine to vary the height of cut; also in a new mode of hanging the sickle."

Claim.—"What I claim as my invention is, 1st, the combination of the grooved cam (M,) and reciprocating lever K^1, so arranged with each other as to give the rake, while in the act of clearing the platform of grain, an increased rapidity of motion, as compared with its backward movement.

"2d, Controlling the motion of the rake by means of the combined action of the hand (I,) ratchet (*i*,) and lever R as set forth.

"3d, The arrangement of the double eccentric (U,) for equalizing the power of the spring (*m*,) on the lever K, in the manner described.

"4th, Forming supports for the vibrating blade, or sickle, by the plates (*f, f, f*,) in sections separate from the fingers, to prevent choking, as described and represented."

---

22. For an *Improvement in Shovel Ploughs;* James H. Forman, Sharon, Alabama, February 10.

Claim.—"What I claim is, the use of the fulcrum pin *d*, and adjusting arrangement of the pin e^2, in combination with the beam and stock of a plough, for the purpose of regulating the dip of the ploughshare, substantially as set forth."

---

23. For an *Improvement in Railroad Switches;* Amos Hodge, Adams, Massachusetts, February 10.

Claim.—"I claim the system of levers, lock bolt, and springs, arranged substantially as herein described, in such manner that the switches are always locked securely in the proper position for the direct passage of a train along the main track, unless intentionally unlocked and shifted, as described, and when shifted, are automatically returned to their position in the line of the main track, and locked there, as soon as the force by which they were shifted is withdrawn.

"In combination with the above, I claim the system of jointed levers, wedge blocks, sliding bars, dogs, dog lever, and hook ended bar, or their equivalents, acting substantially as herein described, in such manner that the switch is shifted automatically, to permit a train to pass from a branch to the main track, and is maintained in such position, until the last car has passed off it, when it returns automatically, to restore the continuity of the main track."

---

24. For an *Improvement in Portable Shower Baths;* Ferdinand Holm, Brooklyn, New York, February 10.

"The nature of my invention consists in the combination of a force pump, with a box of an octagonal or other suitable form, and jointed together at the middle, so as when closed to form a semi-octagonal box, to hold the force pump, jets, etc.; also in combining with the box or bath tub when opened, a series of leaves, to extend the area of the tub by means of slides, holding the edges of the leaves together, in one continuous rim, to prevent the spray from the jets wetting the floor."

Claim.—"What I claim, therefore, is, the use of the box or tub, for a portable shower bath, made in two halves, in combination with the slide C, leaves D, D, &c., and slides G, G, &c., substantially as set forth."

---

5. For an *Improvement in Grass Harvesters;* William F. Ketchum, Buffalo, New York, February 10.

Claim.—"Having thus fully described my improvement, what I claim therein as new is, 1st, sustaining the rack piece D, in the manner set forth, by projecting a beam C, from the frame above the grass and behind it, to which it is connected by the rods E, as herein fully set forth; and in combination therewith, I claim the shield plate G, in connexion with the beam C, for sustaining the rack piece D, substantially in the manner and for the purpose above described."

---

6. For an *Improvement in Apparatus for Regulating and Measuring the Flow of Gas;* Wm. B. Leonard, City of New York, February 10.

Claim.—"I do not claim the indicating apparatus for showing the quantity of gas or fluid consumed in a given time; nor do I confine myself to the use of any particular mode of indicating it, as it may be performed in various ways; neither do I confine myself to the peculiar form of clock movement or mechanism for giving motion to the disk F; but what I do claim is, 1st, the employment, for the purpose of registering the flow of gases and fluids through an aperture, of a disk F, receiving a constant rotary motion, at an uniform speed, and giving motion to a wheel J, in connexion with the indicating apparatus and the cock B, or its equivalent, in the manner herein described, to wit: the wheel J being moved farther from or nearer to the centre of the disk, as the cock is opened or closed, so as to govern the speed of the wheel, and consequently, the indicators, according to the area of the passage through which the gases or fluids are passing.

"2d, The manner of stopping the clock movement, when the cock or faucet is shut by the arm *q*, on the spindle, *o*, being operated by the wheel J, and the lever *p*, substantially as herein shown.

"3d, The manner of closing the valve D, and shutting off the gas or fluid, when the clock is run down, by an arm S, on a spindle *r*, operated by a spring *t*, and held back by a lever U, stopped by suitables catches, and released by the unwinding of the main spring, substantially in the manner herein specified."

---

7. For an *Improvement in Governors;* Ephraim Morris, City of New York, February 10.

Claim.—"What I claim as new is, an incline or inclines between a hub and cylinder on a shaft, in combination with a resisting spring, or its equivalent, whereby the motion of the parts due to the compression of the spring or its equivalent by the inclines, produces motion to regulate the power, in proportion to the resistance, as described."

---

8. For *Improvements in a Quartz Crusher;* James H. Swett, Boston, Massachusetts, February 10.

"The nature of my invention consists in arranging a metallic cylinder, which may be round or many sided, into which the material to be operated upon is placed, and which has a rotary motion in one direction; and passing through said cylinder, a shaft, carrying any suitable number of curved arms, which have a rotary motion in a direction contrary to that of the cylinder, and which catch up, carry, and throw over a series of metallic balls, by which the material to be ground or crushed is operated upon."

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, in combination with a cylinder containing the quartz, &c., and rotating in one direction, for the purpose of loosening up the material to be ground or crushed, the curved arms arranged upon a shaft therein, rotating in a contrary direction, for the purpose of catching, carrying up, and throwing over the balls by which said material is ground or crushed; the whole being arranged and combined in the manner and for the purpose herein fully set forth."

---

9. For an *Improvement in Seed Planters;* Edward Wicks, Bart, Pennsylvania, February 10.

"My invention consists in so constructing the several distributing wheels, with movable

adjuncts or slides, through which the supply is received by the wheels, as that any latera motion or play of the carrying shaft will not be attendant with the usual friction, or im peding contact, that the distributing wheels now are subject to upon the sides of the aper tures through which the grain is fed."

Claim.—"I do not claim exclusively causing the distributing wheel (constructed witl cogs or teeth as described) to enter the body of the hopper, as such has already been done but what I do claim as my invention is, the employment of a slide D, or its equivalent through which the distributing wheel works, and that, by being movable, operates to avoi friction of the wheel upon the sides of the aperture, (communicating with the hopper,) a liable to be produced by the play of the shaft upon which the distributing wheel, C, i hung, essentially as herein represented and specified."

---

30. For an *Improvement in Processes for Dissolving Gold;* Charles F. Spieker, City o New York, February 10; ante-dated August 10, 1851.

Claim.—"What I claim now as my invention is, the separating of gold from its ores sands, or mixtures, in suitable apparatus, by the use of free chlorine gas, when absorbed by water alone, or by water in combination with an alkali, or an alkaline, earthy, or metallic chloride, containing an excess of chlorine, as set forth in the specification."

---

31. For an *Improvement in Railroad Car Brakes;* Birdsill Holly, Assignor to S. Hewit, E. S. Latham, B. Holly, and A. Downs, Seneca Falls, New York, February 10.

Claim.—"What I claim as my invention is, the fixed and sliding rubbers upon the adjacent axle of a railroad car, in combination with the intermediate cog wheels; the whole arranged and operating substantially as herein set forth."

---

32. For an *Improvement in Excavating and Dredging Machines;* Calvin Willey, Jr., Chicago, Assignor to C. Willey, Jr., and Urial Walker, Babcock's Grove, Illinois, February 10.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, 1st, so arranging the frame upon which the endless chains carrying the ploughs and buckets are supported and carried, as to allow said ploughs and buckets to work outside of the line of said frame, and thereby to sink to any desired depth, without liability of the frame resting upon the bank to be removed, and limiting the depth to which the cutters may sink, as herein described.

"2d, I claim so connecting the machinery for raising and lowering the frames carrying the ploughs and buckets, with the driving power of the machine, that the buckets may be lowered automatically, in such proportion to the motions of the other parts of the machine, as the character of the bottom to be excavated may demand, in manner and for the purpose substantially as described."

---

33. For an *Improvement in the Construction of Grate Bars for Furnaces;* Francis Armstrong, New Orleans, Louisiana, February 17; ante-dated August 17, 1851.

Claim.—"What I claim as new and of my invention is, the form and construction of the grate bars for furnaces having jogs, *a*, in the blade of the bar, A, extending from the lower line or edge of the bar, up to the level of the lower line, C, of the extension, through the fire front, thereby securing the advantage of having said grate bars held permanently in their required position, by the said jogs touching each other, and at the same time leaving all that section of the openings above the jogs, free for the admission of a poker between the bars, to remove any solid matter produced from the combustion of the fuel."

---

31. For an *Improvement in Pumps;* Abel Barker, Honesdale, Pennsylvania, February 17.

Claim.—"What I claim as my invention is, the combination and arrangement of the two barrels, A and B, and the pistons, E and F, in such a manner that the water shall *flow down* through the lower barrel, and up through the upper barrel, thereby enabling

one piston to act in descending, and the other in ascending, for the purpose of producing a constant flow of water, substantially in the manner herein described.

"I also claim the peculiar construction of the lower piston, F, by which its valve allows the water to pass downward, and closes by its own weight, either with or without magnetizing, substantially in the manner and for the purpose herein decsribed."

---

35. For an *Improvement in Explosive Compositions for Blasting Rocks;* Edward Callow, London, England, February 17; patented in England, August 6, 1850.

Claim.—"What I claim as my invention is, the explosive compound herein described; but I would have it understood, that some of the materials mentioned as component parts in my improved explosive compound, have been used before by pyrotechnists and others, in the manufacture of various fire-works; and that as regards such use, I do not claim any thing in my invention, except so far as regards the combination I have given, and for the purposes also mentioned.

"The shape and material of the cartridge cases have nothing to do with my invention, they being optional with the party using them. I have only given drawings of, and described what I have found to be the most convenient for the purpose."

---

36. For an *Improvement in Fences;* John Card, Gainesville, New York, February 17.

Claim.—"What I claim as my invention is, the construction of the posts in pairs, and their combination with the rails, in such a manner as to render the fence strong and firm, by balancing the weight of the fence, by its construction as herein above described, upon each side equally of the centre of each pair of posts, and securing at the same time the advantages of a straight fence, and of posts standing upon the surface, and secured from decay.

"I do not claim as my invention the construction of the posts as herein above described, either singly or in pairs; but the combination of the advantages above mentioned, as substantially described in this specification, and as above claimed by me."

---

37. For *Improvements in Railroad Gates;* Egbert P. Carter, Yorkshire, New York, February 17.

"The nature of my invention consists in so constructing rail gates, to be opened and held open by the action of the cars in passing, as that the gate shall swing upward in the arc of a circle, from an axis in the centre of the hub of the gate, by means of a shaft, which the passing train first rotates and then holds fixed, thus avoiding the necessity of having any portion of the apparatus to sink below the level of the track, which is liable to become inoperative by snow, ice, &c."

Claim.—"Having thus fully described my invention, what I claim therein as new is, the method herein described for balancing a railroad or other gate, viz: by means of a spring, coiled around a stationary axis, to which it is attached by one end, the other end being attached to the disk which forms the hub or centre of the gate turning on said axis, substantially as herein described.

"I also claim the use of the rock shaft, provided with the cam ledges and straight ledge, to be operated upon by the wheels of the passing train, and the cams for winding up the chains which draw up the gates; the whole being arranged in the manner and for the purpose herein substantially set forth and shown."

---

38. For *Improvements in Machinery for Making Chains;* John M. Crawford, New Castle, Pennsylvania, February 17.

"The nature of my improvement consists in a certain new and useful combination and arrangement of mechanical devices, which operate successively upon the wire or rod, (previously heated to a welding heat,) cutting a piece therefrom of the proper length to form the link, bending the same to a semi-oval or U shape, lapping the ends and welding them together; and thus form the link, and deliver it upon a vibrating suspending arm, on which it is turned, and carried to a seat, from which (seat) it is displaced by the formation of the succeeding link; there being required during the operation of the machine, but one attendant to feed the wire or rod in the machine."

Claim.—"Having thus described the construction and operation of my machine for

making chain, I wish it to be understood, that I do not claim to be the original inventor of "the combination of the parts, movements, and operations, in one machine, which are required to make jack chains by one process from straight wire, after it is cut off in suitable lengths, to the finished chain;" nor do I claim "the stud pin with a recess in it, as a mandrel, around which the bow of a link is bent, while the bow of another link is held in the recess, thereby forming a continuous chain;" nor do I claim a partly revolving mandrel, with a stud pin and nipper, and other appendages, for bending the last bow of each link, as combined, used, and constituting part of a machine" already patented.

"But what I do claim as new and of my own invention is, 1st, The combination of the welding dies, R R^1, with the swage N, for welding or uniting the lapped ends of the link, and dropping the latter upon the suspending arm, S^1, the advance of the die, R, moving the link to the face of the swage, where the operation of welding is performed.

"2d, Attaching the vibrating arm, S^1, to the bed, w^2, of the die, R^1, and operating the same in such manner as to receive the finished link, and suspend the same in a position to be seated.

"3d, The combination of the slide bar, V, turning lever, W, and cross bar, g^2, constructed and arranged as described and represented; the said bar, V, and lever, W, operating to turn and push the finished link into its seat.

"4th, The link seat, O, attached to the lever, *j*, beneath the swage, N, for receiving the finished link from the suspending arm, S^1, and holding the same until the wire or rod for the succeeding link is fed into the finished link, cut off, bent, and ready to be welded.

"5th, The employment of the curved holding lever, Z, attached to the lever, *j*, in combination with the pendant cam bars, 4 and 5, short pendant arm, 9, arm, Y, pin, 3, and spring bar, X, constructed, arranged, and operating as described; whereby the finished link is held in its seat and liberated therefrom simultaneously with the advance of the die, R, to finish the succeeding link.

"6th, The combination of the spring bar, X, with the shear cutter, L, whereby the pendant cam bars, 4 and 5, are attached, through the pin, 3, and springs, 8 8, to hold or relieve the arm, Z, from the seated link, as described and shown in the drawings.

"Finally, I claim making the grooves, *b* b^1, in the bed dies, J J^1, slightly oblique to their faces, for the purpose of canting the ends of the rod or wire, so as to allow them to lap, when bent by the levers, P P, as described."

---

39. For an *Improvement in Bran Dusters;* Lewis Fagin, Cincinnati, Ohio, February 17.

Claim.—"Having thus fully, clearly, and exactly described the nature, construction, and operation of my improvements in the flour bolting and bran dusting machine, what I claim therein as new are, 1st, The arrangement of the vanes in the blast cylinder, substantially as described in the specification and illustrated by the diagram, fig. 6, whereby I attain a free escape for the blast, and effectually prevent the accumulation of flour within the blast cylinder, and thus keep the cylinder truly balanced on its shaft or axis.

"2d, The insertion of vertical rows of beaters on each rib of the bolting cylinder, and on the vanes (No. 2) of the blast cylinder, from top to bottom, for the purpose of beating the offal at each successive rib and vane, and preparatory to each jet of blast, substantially as described."

---

40. For an *Improvement in Bran Dusters;* Abel Hildreth, Newark, Ohio, February 17.

Claim.—"What I claim as my invention is, the arrangement and combination of the several parts of a bolt or bran duster, in such manner that the draft generated by the rotation of the beaters within the bolting screen shall act as a conveyor or elevator, for the purpose of transferring the bran or meal from any portion of the mill to the bolting or dusting apparatus, and shall at the same time cool the bran or meal thus conveyed.

"I also claim the scouring apparatus herein described, consisting of a series of pairs of toothed disks, arranged in vertical order above each other, at such distances apart as will admit of the free passage of the meal or bran between them, alternately from the centre to the periphery between the disks of each pair, and from the periphery to the centre between the pairs of disks.

"I likewise claim the method herein described, of shielding the current of mixed air and meal or bran from the centrifugal action of the revolving disks, by means of stationary diaphragms, arranged as herein set forth."

11. For *Improvements in Stop Motions of Looms;* Lora B. Hoit, Millbury, Massachusetts, February 17.

"The nature of my invention consists in providing a spring, which is acted upon by the lathe, or a screw in it, to traverse a slide, and cause the belt that propels the loom to be thrown upon the loose pulley, and stop the loom when the weft breaks or runs out; thereby dispensing with the lever, cam, and stud upon which the lever vibrated; and in applying a spring or its equivalent, to act upon the prongs of the lever, which has a catch upon it, so as to raise said catch when the shuttle is in the box at the opposite end of the lathe."

Claim.—"What I claim as my invention is, 1st, The forked lever, *g*, and spring, *m*, constructed and arranged substantially as herein described, in combination with the grid, or pins, *i i i*,) and slide, *b*, to release the slide when the weft is properly drawn across the grid; and to traverse it, to stop the loom when the shuttle ceases to draw the weft across said grid.

"2d, Is the spring, *q*, or its equivalent, to stop the prongs of the lever, *g*, and raise the catch, *n*, so as not to stop the loom when the shuttle is in the box at the opposite end; the parts being arranged substantially as herein described."

---

12. For a *Meter for Steam Boilers;* William H. Lindsay, City of New York, February 17.

Claim.—"I do not claim the special use of a plunger, piston, or pistons, poppet valves, or well known cocks, the same being long known and used: but what I do claim as my invention, as constituting a new and useful improvement in the construction and operation of a fluid meter, is, the means herein set forth, for maintaining the feed to the boiler, &c., and the closing or cutting off the communication to and from the meter, in case of accident, or from other causes, arranged and operating for the purpose and with the intent substantially as described."

---

13. For an *Improvement in Steam Boilers;* James Millholland, Reading, Pennsylvania, February 17.

"The object of my invention is to protect the fire-box from over heating, and at the same time to insure the most thorough aud complete combustion of the coal burnt therein."

Claim.—"Having thus described my improvements in locomotive's boilers, what I claim herein as new is, the contracted grate in the fire-box, in combination with a supplementary chamber of combustion, supplied with air, and situated at a point intermediate between the fire-box and smoke-box, which is connected with the former and the latter by flues, in the manner substantially as herein described."

---

14. For an *Improvement in Grain and Grass Harvesters;* Robert T. Osgood, Orland, Maine, February 17.

Claim.—"What I claim as my invention is, the manner of placing the toggle joint purchase, fig. 4, (with the transverse acting joint, V,) upon the end of the cutter arm, fig. , to act in conjunction with the other machinery, giving it as it were a double purchase, by hanging the sweep so that the arm of the crank will be horizontal or parallel with the toggle joint when straight, and giving the cutters its double motion, by acting above and below this line. When the crank or hand, *o*, is up, the purchase is at the upper end of the sweep; when half way down, it is at the lower end or joint, varying like a circular or screw power."

---

15. For an *Improvement in the Feeding Apparatus for a Grain Thresher;* William R. Palmer, Elizabeth City, North Carolina, February 17.

Claim.—"What I claim as my invention is, the method herein described of preventing accidents to the feeder of a threshing machine, by interposing between him and the cylinder a roller, or the equivalent thereof, which is arranged across the throat of the machine, and is supported and guided substantially in the manner and for the purposes herein set forth."

46. For an *Improvement in Banding Pullies;* Robert W. Parker, Roxbury, Massachusetts, February 17.

"The nature of my invention consists in driving circular saws or other machinery by a peculiar arrangement of a belt and pullies, by which the main driving pulley is made to pinch the band at the points in the intermediate pullies with any desired force; much of the friction attendant upon the ordinary mode of driving saws and other machinery is dispensed with, the arrangement is more economical, and it is more simple, and a greater effect with the same expedition of the power is obtained."

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, arranging the driving pulley, B, in reference to pullies, E and F, that the band passing over these pullies is not only pressed, with any desired force, against the periphery of the driver, B, but is also pinched between the pullies, B E, and B F, they operating upon the band as feed rollers, substantially in the manner herein described."

---

47. For *Improvements in Capstans;* Peter Roberts, City of New York, February 17.

"The nature of my invention consists of a new combination of mechanical elements, arranged within the base of a machine, known by the following names, viz: capstan, windlass, or heaver, as commonly used on shipboard; the object of which arrangement is the continuous winding motion of that part called the head, (upon which the rope or chain is wound,) while the levers or heavers are caused to move alternately backwards and forwards."

Claim.—"What I claim as my invention is, the combination of the following mechanical elements, viz: the vibrating tumblers acted upon by handspikes; the slide, D, with its racks; the cog wheels, P and Q, the former formed also with ratchet teeth; the ratchet wheel, G, and its hollow shaft; the pawls, M and N; the whole arranged within the base, B, and with respect to each other, and acting substantially as described."

---

48. For an *Improvement in Rotary Cultivators;* Pleasant E. Royse, New Albany, Indiana, February 17.

"The chief point of my invention consists in a peculiar construction of the chisel bevel cogs on the driving wheels, for taking and maintaining a firm hold of the ground, the character of which will be apparent."

Claim.—"I am aware that most of the parts contained in this description of my improved machine are not in themselves, separately considered, novel; but that they have, singly or more or less connectively, in similar machines, or others for a different purpose, been employed, patented, or used; such as the front running wheel, D, in ploughs and cultivators driving wheels, A A, having spurs, in various locomotive machines, chain belts and wheels, for communicating motion, revolving shares in harrowing machines; also, in harvesting and other machines, the curved slots and specified appliances, for raising and lowering the shaft, without affecting the stretch of the belt or belts.

"I therefore do not claim as new any of these parts, separately considered, or irrespective of the manner or form, in which I propose in combination to apply them for the purposes and to produce the advantages specified.

"But what I do claim as my invention is, the construction of the teeth on the main or driving wheels of a chisel-formed bevel; that is to say, one face being a continuation of the line or plane of the radius of said wheel, while the other face is beveled, to meet it at an angle somewhat less than forty-five degrees, for the purpose of striking into and taking a firm hold of the ground, in the manner and for the purpose set forth."

---

49. For an *Improvement in Weighing Machines;* William and Thomas Schnebly, City of New York, February 17.

Claim.—"What we claim as our invention is, the employment of the method or methods of securing the lever or levers connected with the platform by means of a stop or brake, to hold the platform substantially as described, when this is combined with the pendulous scale or balance, and the apparatus for registering the extent of motion of the said pendulous scale or balance, substantially as specified; by means of which combination we are enabled to register accurately the weight of bodies that roll or slide, or are thrown on

the platform, and prevent the apparatus from registering, in addition to the actual weight, the momentum of the descending weight of the body to be weighed.

"And we also claim the employment of the mechanism which registers the number of weighings, substantially as specified, when this is combined with the pendulous balance or its equivalent, and its register for registering the sum of the weights weighed by the pendulous balance, substantially as described, whereby an accurate register is kept, not only of the number of articles which have been weighed, but also of the whole weight of what has been weighed, as it is often important to ascertain not only the sum of the things weighed, but also the number of articles which make up that sum."

---

50. For an *Improvement in Spoons for Administering Medicines;* J. C. Taylor, West Liberty, Ohio, February 17.

Claim.—"What I claim as my invention is, the particular construction of my spoon with a sliding bottom, and a piston slide, exactly fitting the cavity of the spoon, and the sliding rod, so arranged that it may be slid in at the same moment that the slide tongue or bottom is drawn out, thereby quickly emptying the spoon of its contents.

"I do not claim that my spoon should be a graduating or measuring spoon, but merely for administering medicines already graduated by a physician.

"I claim also, that my spoon will secure, from its arrangement, the advantage of preserving the teeth, and administering all the medicines graduated by the physician, a difficulty often experienced in treating children."

---

51. For *Improvements in Knitting Machines;* Timothy Bailey, Ballston Spa, New York, February 24.

Claim.—"What I claim as my invention is, 1st, Releasing the hanging plates, *k*, from the lever, Q¹, by the inclined projections, 5, as they are drawn up, so as to let the uprights, *m*, and lever, U, raise the locking bar.

"2d, The combination of the catch, *n*, (fastened to the upright, *m*,) spring, V², lever, U, operated by the groove, E, in the curve, to raise the locking bar, so as to allow the slur to operate and depress the sinkers, to divide the loops and form the stitches; and to raise the lever, Q¹, so as to be caught by the lip, 4, upon the plate, *k*, to lock down the locking bar."

---

52. For an *Improvement in Cast Iron Car Wheels;* Albert G. Bristol and Joel C. Jackson, Rochester, New York, February 24.

Claim.—"What we claim as our invention is, the making of car wheels with double plates, extending from the hub to the tread; the plate forming the face of the wheel to be slightly curved backwards, so that a section of it through the centre shall present a very flat arch, whose extremities abut against the rim of the wheel; the back plate, as it spreads from the hub, to be curved in the same direction as the front plate, but as it approaches the tread to be gradually depressed at equal intervals, till it meets the front plate; to be thus thrown into a fold or plait, forming two walls of a triangular cavity, of which the third side is made by the face plate, and in this form to be continued till it meets and unites with the tread; the whole to be in the manner and form substantially as shown in the accompanying drawings."

---

53. For a *Duplex Eccentric Valve Motion;* John J. G. Collins, Chester, Pennsylvania, February 24.

Claim.—"What I claim is, the employment of cogs on or to eccentrics wheels, for giving motion to eccentrics or their equivalents, on a second motion, in combination with the guard or framing attached to the clips or straps of the driving eccentric, and so formed and arranged as to unite both vibrating motions derived from the driving and driven eccentrics into one motion, for working the slide and other valves of steam engines, in the manner and for the purpose as specified."

---

54. For an *Improvement in Straw Cutters;* Absalom B. Earle, Oneonta, New York, February 24.

Claim.—"What I claim in the foregoing as new is, the method of cutting vegetable substances, by a combined chopping or percussive and shearing cut, produced by means

of stationary knives at the mouths of the feeding troughs, moving knives carried on an oscillating lever and revolving tappets, which actuate the oscillating lever as described."

55. For an *Improvement in Endless Chain Horse Powers;* Horace L. Emery, Albany, New York, February 24.

Claim.—"Having thus fully explained my improvement and its purposes, what I claim as new is, the manner of constructing the converge gears, pinions, and pullies of the endless chain horse power, with their outer sides concave at their centres, sufficiently to receive their fastenings within the plane of the inner side of the arms, spokes, or faces of such of the gears and pullies, which, when confined upon one shaft, and overreach the other shaft, may pass both shaft and fastening freely; the faces of the several couplings or shoulders upon the shafts, as also the ends of the shafts themselves, being in the same planes, and all the fittings and fastenings of the shafts, gears, and pullies agreeing with each other, for the purpose and in the manner substantially as described."

56. For an *Improvement in Vessels for Making Ink;* Alexander Harrison, Philadelphia, Pennsylvania, February 24.

"The nature of my improvement consists in arranging a number of reservoirs or vessels in succession, and so connecting them together, that the fluid from the top of the first shall be discharged into the second vessel near its bottom, the fluid from the top of the second into the third reservoir near its bottom, and so on, thus exposing the entire quantity of ink to the oxygenating action of the atmosphere in each vessel successively, and at the same time draw'ing off from each cask into the successive one, only the purer portions of its contents."

Claim.—"What I claim as my invention is, the arrangement and connecting together a series of vessels for manufacturing ink, in the manner and for the purposes herein set forth."

57. For an *Improvement in the Manufacture of Zinc White;* Samuel T. Jones, City of New York, February 24.

Claim.—"What I claim as my invention is, the use of a porous or fibrous bag, or receiving chamber, with porous sides or bottom, or an air-tight chamber, with a straining or porous bag adapted to the inside thereof, and used in connexion either with a blowing or exhausting apparatus, so that the products of the distillation and oxygenation of zinc, or other volatile metals, may be separated from the accompanying air and gases, which latter will be forced or otherwise drawn through the pores of the cloth bag or chamber, and escape into the atmosphere."

58. For an *Improvement in Saw Mills;* Oliver B. Judd, Rockton, New York, February 24.

Claim.—"I do not claim the common carriage, as shown in the annexed drawings; but what I do claim is, simply and substantially raising the tail block as above described, or in any other way substantially the same."

59. For an *Improvement in Water Wheels;* Joel B. Nott, Guilderland, and William S. Kelly, Princeton, New York, February 24.

Claim.—"We do not claim a water guide, as described in the foregoing specification, composed of a scroll or sections of scrolls, or arcs of circles, or sections of polygons, as concentric with the wheel, to direct the action and impulse of the water upon the concentric wheel, having its guiding surface between parallel planes, as the scroll, and not spiral, as the screw. But what we do claim is, a water wheel composed of a scroll or section of scrolls, or arcs of circles, or sections of polygons, substantially as above described, in combination with a fixed internal guide or guides, made in manner substantially similar to the float or floats of the wheel, but with the direction in reverse, there being sufficient space between the outer extremities of the guide or guides, and the inner extremity of the float or floats, to allow the water to pass between them in all positions; the space between them being substantially on the disk of the wheel, thus causing the driving current of water to

pass between the two, in the direction of the wheel's motion, and act directly upon the inner face of the wheel, propelling the wheel in the same direction with the current; the water being discharged, nevertheless, at the extremity of the scroll, helix, or arcs of circles, or sections of polygons, or either of which the wheel may be composed, in a direction opposite to that in which the wheel revolves."

---

60. For *Improvements in Cut-Offs;* Frederick E. Sickels, City of New York, February 24.

"In cut-offs as heretofore constructed, in operating the catch by the closing movement alone, the valve cannot be tripped until sufficient motion had taken place to operate the whole extent of the catch, thus occasioning an unavoidable delay in tripping the valve.

"The nature of my invention, therefore, consists in operating the catch or hold, and liberating the valves of trip cut-offs on the movement to close, or return of the valve motion, by means of an adjustable cam or lever, after it has been partially operated upon, on the opening movement of the valve motion, so as to leave as little movement of the catch, to effect the liberation of the valve, as may be desired to be accomplished by the return movement; thereby being enabled to liberate the valve and cut off the steam, as near the first of the return movement as may be desired."

Claim.—"Having thus fully described my invention, what I claim therein as new is, operating the catch or hold, and liberating the valves of cut-offs, on the movement to close, or return motion of the valve, after it has been partially operated upon in opening, substantially in the manner as herein described, so as to leave as little of the catch to be operated, to effect the liberation of the valve, as may be desired to be accomplished on the return movement; thus being enabled to liberate the valve and cut off the steam, as near the first of the return movement as may be desired."

---

61. For an *Improvement in Apparatus for Boring Hubs for Boxes;* Henry Sidle, Dillsburg, Pennsylvania, February 24.

"The nature of my invention consists in providing an auger and box regulator, for the purpose of boring the hubs and regulating the boxes of wagon, carriage, railway cars, and other vehicle wheels."

Claim.—"What I claim as my invention is, the iron shaft in two parts, with the socket and screw in the centre, marked O, so as to increase or diminish the length of said shaft, and also to feed the bitts as described, whereby a hub may be clamped, bored at both ends for the boxes, and removed from the machine, without removing the cutters from the shaft, replacing them, or changing ends of the hub or shaft."

---

62. For an *Improvement in Water Gun for Extinguishing Fire;* Hiram Strait, Covington, Kentucky, February 24.

Claim.—"What I claim as of my own invention in the fire gun are, 1st, The combination of the flanch, cap, and guard, constructed and operating in a manner substantially as described.

"2d, Constructing the barrel of the fire gun of successive layers of sheet metal, and casting the breech, trunnion ring, and flanch thereto, in manner substantially as described."

---

63. For an *Improvement in Grain Winnowers and Weighers;* Thomas T. Strode Coatesville, Pennsylvania, February 24.

Claim.—"Having thus described my improvement in the combined weighing and winnowing machine, what I claim therein as new is, combining a balance lever weigher with the lower portion of the winnowing machine, whereby the grain, when cleaned, is weighed and removed therefrom, by a portable receiver, as described and represented.

"I also claim constructing the balance lever weigher as represented, and mounting the same upon pivots, or knife-edge bearings, whereby its rearward projecting ends are made to serve as ways or inclined planes, upon which is mounted a portable receiver, so as to balance the weigher, whilst its frontward ends are graduated and furnished with weights by which the number of bushels weighed at each time may be indicated, as described."

64. For an *Improvement in Grain Dryers;* T. E. Weed, Williamsburgh, New Yo February 24.

Claim.—"I claim the centre hollow shaft, B B, for the double purpose, first, for formi the support in the centre, for the steam chambers and pans, as described; and, second, forming a passage for the steam to pass into each of the chambers, for heating the machi

"2d, I claim, substantially as described, the arrangement of the air chambers I I, betw the steam chambers, and pans, with openings in them, for a thin blade of air to escape a circle from the centre, at a right angle, or nearly so, with the main shaft, B B, and pipe extending through the machine, as shown, for supplying the chambers with air, o rating substantially in the manner and for the purpose as herein set forth."

---

65. For an *Improvement in Floating Docks;* Orrillus T. Williams, Smithland, K tucky, February 24.

Claim.—"Having thus described my dock, and the various uses to which it is appli ble, I will state, that I do not claim forcing air into a vessel immersed or partly immer in water, for the purpose of rendering it buoyant, or of admitting water, for the purpose allowing it to sink; but what I do claim as my invention is, so forming a cylindric prismatic dock, as to perform the operation of elevating a vessel above the surface, by co bining the buoyancy obtained by injecting air into the cylinders, with the forced revolut of the cylinders on their axis, while lying on the water, substantially as herein set fort

"2d, I also claim making the rigid submerged elevator in such a manner as to be actua by compressed air, only so long as to get rid of the contained water, and to be freed from interior pressure, while sustaining its load above the surface of the water, whereby liability to accident, from the escape of air under high pressure, is avoided, substantially herein described.

"3d, I also claim, in combination with a flexible tube for conveying injected air, the of the revolving pipe directly connected therewith, whereby the pipe may be turned herein described, for varying the direction of the current of injected air, by turning flexible tube, as herein set forth.

"4th, I also claim, in combination with the flexible tube for the injection of air, opening in the bottom of the cylinder, and the vents in its top, whereby the dock is r dered buoyant, while wholly immersed in water and freed from interior pressure, on risi to its maximum height on its surface, substantially as herein set forth.

"5th, I also claim the double parbuckle, $c\ c^1$, or analogous turning apparatus, wheth a rope or a chain with friction rollers in its links, (fig. 6,) be used for the purpose of tu ing the opposite elevators ($B\ B^1$) in opposite directions, for the purpose of raising vessel above the water, in the manner substantially as herein set forth."

---

66. For an *Improvement in Apparatus for Lightening Vessels;* Orrillus T. Willia Smithland, Kentucky, February 24.

Claim.—"What I claim as my invention is, the elevator formed by combining joint frames of inflexible materials, with flexible enclosures made air-tight above and open belo when said jointed frames are so constructed as to attach themselves to the bottom o vessel, after being let down by its side, and the flexible enclosure so arranged as to ad of the injection and retention of air beneath it, for the purpose of buoying up the ves substantially as herein set forth.

"2d, I also claim making jointed elevator frames, in such a manner as to adjust the selves to the form of a vessel's sides, whereby the flexible enclosure for air is allowed come in close contact with the outside of the vessel, in the manner and for the purpo herein set forth.

"3d, I also claim, in combination with a flexible enclosure for retaining the air, t hook, D, upright or chain, C, brace, B, and stretcher, S, whereby the elevator is ma capable of attaching itself to the vessel, and of raising the same without the necessity passing a support beneath the keel, as herein set forth."

Designs for February, 1852.

1. For a *Design for a Mantel Grate Frame and Summer Piece;* James L. Jack City of New York, February 3.

Claim.—"Having thus fully described the nature of my design, what I claim therein

new is, the combination and arrangement of the figures, flowers, and ornaments herein represented, the whole forming an ornamental design for a mantel grate frame and summer piece."

2. For a *Design for a Grate Frame and Summer Piece;* James L. Jackson, City of New York, February 3.

Claim.—"Having thus fully described the nature of my design, what I claim therein as new is, the combination and arrangement of the ornamental figures herein represented, and forming an ornamental design for a grate frame and summer piece."

3. For a *Design for Grate Frames;* James L. Jackson, City of New York, February 3.

Claim.—"Having thus described the nature of my design, what I claim therein as new is, the combination and arrangement of ornamental figures herein represented, and forming an ornamental design for a grate frame."

4. For a *Design for Grate Frames;* James L. Jackson, City of New York, February 3.

Claim.—"Having thus described the nature of my design, what I claim therein as new is, the combination and arrangement of the ornamental figures herein represented, and forming an ornamental design for a grate frame."

5. For a *Design for Hair Combs;* James Shields, Fishkill, New York, February 3.

Claim.—"What I claim to be new and original is, the design and configuration of a ladies' hair comb, as described above, and represented in figs. 1 and 2."

6. For a *Design for Stoves;* Conrad Harris and Paul W. Zoiner, Cincinnati, Ohio, February 10.

Claim.—"What we claim as our invention is, the combination of the scrolls and foliage, arranged as set forth in the annexed drawings, so as to form an ornamental design for coal and wood parlor stoves, to be known and called the Juno Parlor."

7. For a *Design for Ladies' Hair Combs;* James Blackman and Charles Skidmore, Newtown, Connecticut, February 17.

Claim.—"What I claim as new is, the design, A, composed or formed of a series of ringlets or curls, *a,* said ringlets or curls forming a curve, and placed on the upper part of the back of the comb; the ringlets or curls being in an inclined position, those on one side of the centre of the comb inclining in direction reverse from those on the other side, substantially as herein shown and described."

8. For a *Design for a Grate Frame and Summer Piece;* James L. Jackson, City of New York, February 17.

Claim.—"Having thus described the nature of my design, what I claim therein as new is, the combination and arrangement of the ornamental figures herein represented, and forming an ornamental design for a grate frame and summer piece."

9. For a *Design for Stoves;* James Leffel, Springfield, Ohio, February 24.

Claim.—"Having thus described and represented my design for stoves, what I claim therein as new is, the combination of the above ornaments, arranged as described."

10. For a *Design for Parlor Stoves;* N. S. Vedder and William L. Sanderson, Troy, Assignors to Warren, Swetland & Little, Half Moon Village, New York.

Claim.—"Having thus described our design of stove, what we claim is, the design and configuration of stove, substantially the same as described and represented in the annexed drawings."

LAW REPORTS OF PATENT CASES.

Reported for the Journal of the Franklin Institute.

Circuit Court of the United States, Northern District of New York, Ross Winans vs. the Troy and Schenectady Rail Road Company.

Action at Law for the infringement of Ross Winans's patent for the improvement commonly known as the Eight-wheel Railway Car.
Defences—Want of originality of invention.
Invalidity of patent—No infringement.

This was an action for the infringement of a patent granted to Ross Winans, on the 1st of October, 1834, for an improvement in the construction of cars or carriages intended to run on rail roads. The suit was commenced on the 14th of July, 1847, and was tried at the term of the Circuit Court of the United States, holden at Canandaigua, June, 1850, before Judge Conklin and a jury—Messrs. Spencer, Keller and Blatchford for plaintiff, and Messrs. Stevens and Buel for defendant.

The nature of the improvement patented, is thus set out by the specification of the patent.

"The object of my invention," the patentee says, "is, among other things, to make such an adjustment or arrangement of the wheels and axles as shall cause the body of the car or carriage to pursue a more smooth, even, direct and safe course than it does as cars are ordinarily constructed, both over the curved and straight parts of the road, by the before-mentioned desideratum of combining the advantages of the near and distant coupling of the axles and other means to be further hereinafter described." This is the object of the plaintiff's invention as stated by him. He then goes on to describe the means he has invented to effect the object he has specified.

"For this purpose," says he, "I construct two bearing carriages, each with four wheels, which are to sustain the body of the passenger or other car, by placing one of them at or near each end of it in a way to be presently described. The two wheels on either side of the carriages are to be placed very near to each other, the spaces between their flanches need be no greater than is necessary to prevent their contact with each other. These wheels I connect together by means of a very strong spring—say double the usual strength employed for ordinary cars—the ends of which spring are bolted, or otherwise secured to the upper sides of the boxes, which rest on the journals of the axles; the larger leaves of the springs being placed downwards and surmounted by the shorter leaves. Having thus connected two pairs of wheels together, I unite them into a four wheel bearing carriage, by means of their axles and a bolster of the proper length, extending across, between two pairs of wheels, from the centre of one spring to that of the other, and securely fastened to the tops of them. This bolster must be of sufficient strength to bear a load upon its centre of four or five tons. Upon this first bolster I place another of equal strength, and connect the two together by a

centre pin or bolt passing down through them, and thus allowing them to swivel or turn upon each other, in the manner of the front bolsters of a common road wagon. I prefer making these bolsters of wrought or cast iron; wood, however, may be used. I prepare each of the bearing carriages in precisely the same way. The body of the passenger or other car, I make of double the ordinary length of those which run on four wheels, and capable of carrying double their load. This body I place so as to rest its whole weight upon the two upper bolsters of the two before mentioned bearing carriages or running gear. I sometimes place these bolsters so far within the ends of the body of the car, as to bring all the wheels under it; and in this case, less strength is necessary in the car body, than when the bolster is situated at its extreme ends. In some cases, however, I place the bolster so far without the body of the car, at either end, as to allow the latter to hang down between the two sets of wheels or bearing carriages, and to run, if desired, within a foot of the rails."

He then goes on to speak of some particular features of this invention, and finally he states explicitly, in a summary at the end of the specification, what he claims, and what he does not claim, as follows:—"I do not claim, as my invention, the running of cars or carriages, upon eight wheels, this having been previously done; not, however, in the manner or for the purposes herein described, but merely with a view of distributing the weight carried, more evenly upon a rail or other road, and for objects distinct in character from those which I have had in view, as herein before set forth. Nor have the wheels, when thus increased in number, been so arranged and connected with each other either by design or accident, as to accomplish this purpose. What I claim, therefore, as my invention, and for which I ask a Patent, is the before described manner of arranging and connecting the eight wheels, which constitute the two bearing carriages with a rail road car, so as to accomplish the end proposed by the means set forth, or by others which are analogous and dependent upon the same principles."

The defendant denied that Ross Winans was the original inventor of the improvement thus described and claimed. He contended that the description given of the invention, was not sufficiently full and clear to enable others to use it—that he had abandoned his invention before obtaining a patent; and lastly, that the defendant's cars were no infringement of the patent. The defendant introduced the testimony of a number of witnesses in support of these positions, and the plaintiff introduced a number of witnesses to rebut this testimony. Judge Conkling reviewed all the points raised, in an elaborate charge to the jury.

After concluding his charge, his Honor, Judge Conkling, in answer to several prayers for instructions, offered by the defendant's counsel, instructed the jury in substance as follows:

That it was undoubtedly true that a patent could not be taken merely for a purpose, end or object, but that he doubted the pertinency of any instruction on that point in this case; because the patent here was not for a purpose, but for the means of effecting a purpose.

That the specification was sufficient, if the patentee had described a carriage susceptible of an attachment of the power to the body, and if

the drawing showed such mode of attachment, and that the plaintiff suffered no disadvantage from not stating it in his written specification, and although the drawing was not to be taken into consideration for the purpose of measuring the extent of the claim, yet it might be considered in ascertaining whether what he claimed was new.

That the patent was valid, if the plaintiff's car was substantially, on the whole, a new and useful thing.

That if a thing, substantially like the plaintiff's car had been described, prior to his invention, in some public work that had been produced, then the patent was not good; but that it was not enough that the description should merely suggest the idea of the invention.

That it was a question of fact for the jury, whether the specification was sufficiently exact and intelligible, in reference to the position of the trucks.

That, in order to find for the plaintiff, the jury must be convinced that what the plaintiff had patented is useful; but that any degree of utility was sufficient to support a patent—the word useful, in the patent law, being used in opposition to frivolous or noxious; and that, with regard to the question of side-bearings, although the jury should think it better to have longer bearings than the plaintiff contemplated, that could not take away the utility of his invention, as it was not necessary that the thing patented should be the best possible thing of the kind that could be made.

That if the jury believe that the intermediate time between putting the Columbus into use, and the taking out of his patent, was devoted, by the plaintiff, in good faith, to perfecting of his invention, he cannot be considered as having abandoned it; but that if the invention was perfected in the Columbus, there could be no need of farther experiment.

That, in order to warrant the jury in finding an infringement by the defendants, they must be shown to have used either the same thing, or substantially the same thing, as the plaintiff's invention.

The jury found a verdict in favor of the plaintiff, on both the questions of originality and of infringement.

A motion for a new trial was argued before Judges Nelson and Conkling, at the June term, 1851, of the court, when Judge Nelson delivered the following opinion denying the motion for a new trial:

Nelson, J., I. I have examined the various grounds presented by the counsel for the defendants, on the motion for a new trial, and after the fullest consideration, am of opinion the motion must be denied.

Most of the exceptions taken at the trial, and relied on in the argument here, are founded upon what we regard as an entire misapprehension of the thing claimed to have been discovered by the plaintiff, and for which the patent has been issued. This will be seen on a reference to the instructions prayed for by the defendants, upon which most of the questions in the case arise. They assume that if any material part of the arrangement and combination in the construction of the cars or carriages described in the patent was before known, or in public use, it is invalid; and hence various parts were pointed out by the counsel at the trial, and the court requested to charge that if either of them was not new, the jury should find a verdict for the defendants.

Now, the answer to all this class of exceptions is, that the patentee sets up no claim to the discovery of the separate parts of the arrangement which enter into the construction of his cars. These may be old and well known, when taken separately and detached, for aught that concerns his invention. His claim is for the car itself, constructed and arranged as described in his patent. This, I think, is the clear meaning of the specification, and of the claim as pointed out in it; proving, therefore, that parts of the arrangement and construction were before known, amounted to nothing. The question was whether or not cars or carriages for running on rail roads, as a whole, substantially like the one described in the patent, had been before known or in public use, not whether certain parts were or were not substantially similar.

The argument presupposes that the claim is for the discovery of a new combination and arrangement of certain instruments and materials, by means of which a car is constructed of a given utility; and that if any one or more of the supposed combinations turns out to be old, the patent is invalid. This is the principle upon which much of the defence has been placed; but no such claim is found in the patent; no particular combination or arrangement is pointed out as new, or claimed as such. The novelty of the discovery is placed upon no such ground; on the contrary, the result of the entire arrangement and adjustment of the several parts described, namely, the rail road car, complete and fit for use, is the thing pointed out and claimed as new. This is the view taken by the Chief Justice of the patent, in the case of the present plaintiff, against the "Newcastle and French Town Turnpike and Rail Road Company," tried before him in the Maryland Circuit, and which was adopted by the judge in the trial of this case.

II. It was further insisted on the part of the defendants, that if the relative position of the two bearing carriages to each other, constitutes a material part of the arrangement in the construction of the cars, the patent was void, unless the jury should find that the specification described with sufficient precision the location of these bearing carriages under the body of the car, so as to enable a mechanic of skill in the construction of cars, to place them at the proper distance apart without experiment or invention. It was also contended that the remoteness of the bearing carriages from each other, was not so described in the specification, as to constitute any part of the improvement.

In respect to this branch of the case, the court charged that the relative position of the bearing carriages to each other, in the construction of the car, was a material part of the arrangement of the patentee, and left the question to the jury whether or not he had sufficiently described the position of the trucks, having in view their distance apart, and also from the ends of the car body, suggesting at the same time, that the location must always depend, in a measure, upon the length of the body.

It will be seen on looking into the specification, that the location of the trucks relatively to each other under the body, as well as the near proximity of the two axles of the truck to each other, form a most essential part of the arrangement of the patentee in the construction of his cars.

Great pains have been taken to point out the defects in the existing

four wheel cars; and the impediments to be encountered and overcome in the running of cars upon rail roads, as the latter are usually constructed. The patentee states that in the construction of them, especially when of considerable length, it has been found necessary to admit of lateral curvatures, the radius of which is sometimes but a few hundred feet, and that it becomes important, therefore, to so construct the cars as to enable them to overcome the difficulties presented by these curvatures and to adapt them for running with the least friction practicable on all parts of the road. The friction referred to, is that which arises between the flanches of the wheel and the rail, causing great loss of power, destruction of the wheels and rails, besides other injuries. For this purpose, he constructs two bearing carriages, each with four wheels, which are to sustain the body of the passenger or other car, by placing one of them at or near each end of it, as particularly described. The two wheels on either side of the truck, are to be placed very near each other—the spaces between the flanches need be no greater than is necessary to prevent their contact with each other. The car body rests upon bolsters supported on each of the two bearing carriages, or four wheel trucks, the bolsters so constructed as to swivel or turn on each other, like the two front bolsters of a common wagon. The body of the car may be made of double the length of the four-wheeled car, and is capable of carrying double its load. The truck may be so placed within the ends of the car as to bring all the wheels under it, or without the end, so as to allow the body to be suspended between the two bearing carriages. The patentee further states that the closeness of the fore and hind wheels of each bearing carriage, taken in connexion with the use of the two bearing carriages, arranged as distant from each other as can conveniently be done for the support of the car body, with a view to the objects and on the principles before set forth, is considered by him as an important feature of the invention; for by the contiguity of the fore and hind wheels of each bearing carriage, while the two bearing carriages may be at any desirable distance apart, the lateral friction from the rubbing of the flanches against the rails is most effectually avoided, while at the same time all the advantages attendant upon placing the axles of a four-wheeled car far apart are obtained.

The two wheels on either side of the bearing carriages may, from their proximity, be considered as acting like a single wheel, and as these two bearing carriages may be placed at any distance from each other, consistent with the required strength of the body of the car, it is apparent that all the advantages are obtained which result from having the two axles of a four-wheeled car at a distance from each other, while its inconveniences are avoided.

Among the principles stated by the patentee to be taken into consideration in the construction of the car is, that the greater the distance between the axles, while the length of the body remains the same, the less the influence of shocks and concussions occurring on the road; and hence the relief from them, when the trucks are placed under the extreme ends of the body, is greater than when placed midway between the centre and the end.

It is apparent from what we have already referred to in the specifica-

tion, and still more manifest on a perusal of the whole of it, that the improvement in this part of the arrangement does not consist in placing the axles of the two trucks at any precise distance apart in the construction of the car, or from each end of the body. The distance used must necessarily depend somewhat upon the length of the car and strength of the materials of which it is built, and hence it was impracticable to specify in feet or inches, the exact distance from the ends of the car body at which it would be best to arrange the trucks. Neither do the advantages of a car constructed and arranged as described, depend upon the trucks being placed at a specified distance from the ends, or so that there may be a specified distance between the axles.

Having in view the defects in the existing cars, and other difficulties to be encountered, some considerable latitude may be allowed in this respect, consistent with the object sought to be attained, to remedy the defects in the existing cars. All the principles for the construction of one, for the purpose of overcoming these difficulties, and remedying these defects, are particularly set forth in the description given by the patentee. We think the specification sufficient, and that the court was right in the opinion expressed on this branch of the case.

Any mechanic of skill could readily arrange the bearing carriages in connexion with the body of the car so as to secure the advantages so minutely and clearly pointed out, and which are shown to attend the practical working of cars constructed in the manner described.

III. The questions of originality and of infringement, were questions of fact, and depending upon the evidence, and were properly submitted to the jury. We think the weight of it decidedly with the verdict.

IV. The patent in this case was originally issued 1st October, 1834, and was recorded anew, 7th of June, 1837, according to the Act of Congress of the 3d of March, 1837, (5 St. at large 191.) No drawings were attached to the original patent, nor was there any reference therein to drawings. On the 25th of September, 1848, the patent was extended for the term of seven years, from the 1st of October, 1848. The plaintiff gave in evidence at the commencement of the trial, a certified copy of the patent and specification, certificate of the extension, drawing with references to the same, and an affidavit of the plaintiff, made November 19, 1838. The drawing was not filed at the time the patent was recorded anew, but was filed on the 19th of November, 1838. The counsel for the defendant objected to the evidence on the grounds, 1st, that it appeared that no drawing was annexed to the original patent, and 2d, That the Act of Congress did not make such a drawing evidence. The court also instructed the jury in summing up the case, that the drawing, a certified copy of which had been given in evidence, was to have the same force and effect as if it had been referred to in the specification, and was to be deemed and taken as part of the specification.

The first section of the Act of 1837, provides that any person interested in a patent issued prior to the 15th of December, 1836, may, without any charge, have the same recorded anew, together with the descriptions, specification of claim and drawings annexed, or belonging to the same; and it is made the duty of the Commissioner to cause the same,

or any authenticated copy of the original record, specification or drawing which he may obtain, to be transcribed and copied into books of record kept for that purpose ; *and whenever a drawing was not originally annexed to the patent, and referred to in the specification, any drawing produced as a delineation of the invention, being verified by oath in such manner as the Commissioner shall require, may be transmitted and placed on file, or copied as aforesaid, together with the certificate of the oath, or such drawings may be made in the office under the direction of the Commissioner in conformity with the specification.*

The second section provides that copies of such records and drawings, certified by the Commissioner, or in his absence, by the chief clerk, shall be prima facie evidence of the particulars of the invention and of the patent granted therefor, in any judicial court of the United States, in all cases where copies of the original record, or specification and drawings, would be evidence without proof of the loss of such originals. This section also provides that no patent issued prior to the aforesaid 15th day of December, 1836, shall, after the first day of June, then next, be received in evidence in any court on behalf of the patentee, unless so recorded anew, and a drawing of the invention, if separate from the patent, verified as aforesaid, and deposited in the patent office. See also section third of the same act.

It is quite clear, upon the above provisions of the act, that the court was right in admitting the drawings in connexion with the patent and specification in evidence. The whole together are made prima facie evidence of the particulars of the invention and of the patent granted therefor.

The weight to be given to the drawings furnished under the act by way of enlarging or explaining the description as given in the specification, is another question. That will depend upon the circumstances of each particular case. As a general rule, they will not be effectual to correct any material defect in the specification, unless it should appear that they correspond with one accompanying the original specification for the patent, otherwise, in case of discrepancy between the drawing and specification, the latter should prevail. Care must be taken to avoid imposition by the use of the newly furnished drawing, and for this purpose the specification will afford the proper correction, unless the plaintiff goes further and shows that it conforms to the one originally filed.

The charge that the drawing in this case was to have the same force and effect as if it had been referred to in the specification, and was to be deemed and taken as part of it, was, perhaps, too strong, as it respects the drawings furnished under the act of 1837. The principle is true as it respects those accompanying the original application for the patent, but can hardly be said to be applicable to the full extent stated in the case of these newly furnished drawings. The principle might open the way to imposition and fraud. Assuming that there is nothing but the oath of the party attesting that the drawing affords a true delineation of the invention, the specification should prevail in case of a material discrepancy. But admitting the instruction in this respect not to be strictly correct, and that too much weight was given to the drawing, we *do not see* that it would have altered the result. The specification

afforded a sufficient description of the invention, independently of the drawing. Some slight additions that improved the working of the car, were open to some question, whether they were embraced in the specification, but they did not enter into the essence of the invention, or constitute any substantial part of the improvement. Time and experience usually indicate these slight additions and alterations, and they should be regarded as consequential results belonging to the inventor. It requires time and experience, usually, to perfect the machine, and improvements derived therefrom, are justly due to him.

V. As to the prior use of the car Columbus, and others constructed by the patentee before he made application for his patent, we think the instruction of the court correct. The law allows the inventor a reasonable time to perfect his invention by experiments; and these could be made in this instance, only by putting the car in the service of those controlling lines of rail roads. There were repeated failures in the experiments tried, and the cars abandoned before the perfection of the car described in the patent. These experiments and trials sufficiently account for the previous use set up by way of forfeiture of the invention.

Upon the whole, after a careful examination of the case, and of all the points made by the defendants on the argument, many of which have been noticed above, we are satisfied that the verdict is right, and that a new trial should be denied.

The defendant then moved for "writ of error" to the Supreme Court of the United States, on written briefs filed by D. Buel, Jr., and S. Stevens, Esqs., for the Company, and J. A. Spencer, Esq., for the plaintiff, which was decided January 24th, 1852, negatively.

Counsel for the plaintiff then moved the Court at its late session, for an injunction to restrain the defendants from further violating his rights, upon which motion the injunction was granted.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Notes on the U. S. Steamer Vixen. By Chief Engineer, B. F. Isherwood, *United States Navy.*

The *Vixen* was one of two small war steamers precisely alike, originally built for the Mexican Government by Messrs. Brown and Bell of New York. These steamers, in an unfinished state, were, at the commencement of the late war with Mexico, still in the hands of the builders, from whom they were then purchased by the United States, armed, and employed against their original proprietors. At the termination of the war, one of them (the *Spitfire*) was sold, and the other (the *Vixen*) retained in the Navy.

As first constructed, the engine of the *Vixen* was fitted with a piston valve and an independent slide cut-off; but on the return of the vessel at the conclusion of peace, double puppet valves and a cut-off, invented by Chief Engineer, Wm. Sewell, U. S. Navy, were substituted; also, the depth of hold was increased from 9½ to 12 feet, and the main shaft raised one foot.

The results given in these notes, are from the log of the vessel af the above alterations were made.

Two kinds of boilers have been used in the *Vixen*, viz: the origi boiler with double return drop flues, and the Montgomery boiler w vertical tubes containing the water inside the tubes and having the heat gases applied externally; the space containing the heated gases bei divided vertically in two compartments by a division plate or diaphra placed about midway the tubes. The results from both boilers will given separately.

Dimensions of the Vessel and Machinery.

Hull.

Length on deck,	118 feet.
Beam, „	22 " 6 inche
Depth of hold,	12 " 0 "
Draft of water, deep load (7 ft. 9 in. forward, 7 ft. 11 in. aft,) mean,	7 " 10 "
Draft of water with all coal out, but all other weights in,	6 " 6 "
Mean draft of water for the time steamed,	7 " 2 "
Immersed amidship section at 7 feet 2 inches draft,	147 square feet.
Square feet of immersed amidship section per cubic foot of space displacement of piston,	3·467 "

Rig.—Two masted fore and aft schooner. Under sail alone, the vessel may be conside ed unmanageable.

Engine.—One half beam horizontal condensing engine, Lighthall's patent.

Diameter of cylinder,	3 feet.
Stroke of piston,	6 "
Space displacement of piston per stroke,	42·408 cubic feet

Paddle Wheels.

Diameter from outside to outside of paddles,	18 feet 6 inches.
Length of paddle,	6 " 4 "
Breadth of paddle	2 " 0 "
Dip of paddle at 7 feet 2 inches draft of vessel,	2 " 8 "
Number of paddles in each wheel,	14.
Number of paddles in water in each wheel at 7 feet 2 in. draft,	3.
Area of two paddles,	25⅓ square feet.
Proportion of the area of two paddles to immersed amidship section of hull,	1·000 to 5·802
Proportion of the area of all the immersed paddle surface to immersed amidship section of hull,	1·000 to 1·933

Original Boilers.—Two iron double return drop flue boilers, placed one on eac side the engine.

Length of each boiler,	16 feet.
Breadth "	5 " 6 inches.
Height, "	8 " 1 "
Cubic contents of circumscribing parallelopipedon of each boiler,	711½ cubic feet.
Area of the heating surface in the two boilers,	750 square feet.
" grate " "	47 "
Capacity of steam room in boilers,	584 cubic feet.
" " " and steam pipe,	615 "
Cross area of each of the three rows of flues (both boilers),	6·303 sq. feet.
Cross area of the chimney,	6·303 "
Height of chimney above grate,	43 feet 9 inches.
Mean pressure of steam above atmosphere per sq. in. in boilers,	12½ pounds.
Initial " " " cylinder,	10·3 "
Cutting off at, from commencement of stroke of piston,	26½ inches.
Double strokes of piston per minute,	14·23
Consumption of Pittsburg bituminous coal per hour, with natural draft,	564 pounds.

PROPORTIONS.

Proportion of heating to grate surface, . .	15·958 to	1·000
" grate surface to cross area of each of the 3 rows of flues,	7·457	"
" " " chimney,	7·457	"
" heating surface to cross area of each of the 3 rows of flues,	118·991	"
" " " chimney,	118·991	"
" heating surface per cubic foot of space displacement of piston,	17·685	sq. feet.
" grate " " " "	1·108	"
" heating surface per cubic foot of space displacement of piston, multiplied by number of double strokes (14·23) per minute, .	1·245	"
" grate surface per cubic foot of space displacement of piston, multiplied by number (14·23) of double strokes per minute, . .	0·078	"
Cubic feet of steam room per cubic foot of steam used per stroke of piston, ...	31·527	
Consumption of bituminous Pittsburg coal per square foot of grate surface per hour with natural draft, . .	12	pounds.
Consumption of bituminous Pittsburg coal per square foot of heating surface per hour with natural draft, .	0.752	"
Sea water evaporated by one sq. ft. of heating surface per hour,		
" " one pound of Pittsburg bituminous coal per hour, ...		

These boilers, (Plate II,) under ordinary steaming would furnish steam enough at the above pressure to cut off at half stroke; the piston of course making a proportionally increased number of strokes; the coal is reported as of very inferior quality.

PERFORMANCE WITH THE ORIGINAL BOILERS.

The following results are the mean of 311 hours steaming in the Gulf of Mexico, during the months of February and March, 1851, embracing the usual variety of wind, sea, dip of paddle, and vessel's draft of water. The boilers were six years old, and very foul with incrustation.

Steam pressure in boiler above atmosphere per square inch, 12½ pounds, cutting off at 26½ inches from the commencement of the stroke, giving a mean effective pressure by indicator of 16 pounds per square inch of piston; number of double strokes of piston per minute, 14·23; actual horse power developed by the engine, 86·266.

The speed of the vessel was 6·52 knots of 6082⅔ feet, or 7·511 statute miles.

The diameter of the circle of the centre of reaction was 17¼ feet; the circumference normal to which is 54·19 feet; and

54·19 × 14·23 × 60 = 46267·42 feet = speed of centre of reaction of paddles per hour.
6082⅔ × 6·52 = 39658·99 feet = speed of vessel per hour.

6608·43 feet = slip of centre of reaction of paddles per hour.
or, 14·28 per cent.

The oblique action of the paddles, calculated as the squares of the series of their angles of incidence on the water, is 11·94 per cent.

Total losses of effect by the paddle wheels, (14·28+11·94) 26·22 per cent.

The evaporation was obtained as follows: The steam being cut off at 26½ inches from the commencement of the stroke, there was filled per stroke, 15·507 cubic feet of the cylinder, to which must be added 4 cubic

feet comprised between the cut-off valve (which was also the stea valve,) and piston, including clearance, nozzles, &c., making 19·5 cubic feet of steam of the total pressure of 25 pounds per square in the initial cylinder pressure being 1.7 pounds less than the boiler pressu There would consequently be furnished per hour, (19·507×28·46×(33349·168 cubic feet of steam of that pressure; and as the relative v umes of steam of the density due to that pressure and water are as 10 to 1, there would be evaporated (33349·168÷1044) 31·943 cubic f of water. Taking the cubic foot of sea water at 64·3 pounds, th would be evaporated per hour, by one pound of Pittsburg bitumin coal, $(\frac{31 \cdot 943 \times 64 \cdot 3}{564})$ 3·642 pounds of sea water; to this must be add the loss by *blowing off* at $\frac{2}{32}$ of Sewell's Salinometer, obtained as follo the total heat of steam being taken at 1202° F., the temperature of feed water from the hot well at 100° F., the temperature of the ste and water in the boilers at 241° F., and one-half the water pump in the boilers being blown out; then, 1202°—100°=1102°, the heat us in evaporating the water; and 241°—100=141°, the heat used in *blowi off;* hence, 1102°+141°=1243°, the total heat used and lost, and 141 11·34 per cent. of 1243, leaving the complement of 100 per cent., (100—11·34) 88·66 as the proportion of the total heat evolved from t fuel applied to the evaporation of the water; and as this 88·66 per ce evaporated 3·642 pounds, 100 per cent. would evaporate 4·107 poun The evaporation then by one pound of Pittsburg bituminous coal per ho would be 4·107 pounds of sea water.

Increasing the total weight of water evaporated, in like manner, by t same per centage for loss by *blowing off*, and we have the total evapo tion of 36.029 cubic feet, or 2316·64 pounds of sea water by 750 squ feet of heating surface, being 3·089 pounds of sea water per square fo

The original boilers having become corroded out, a pair of the Mo gomery vertical tubular boilers (Plate III,) were substituted in 1851.

PERFORMANCE WITH THE MONTGOMERY BOILERS.

The following performances of the Montgomery boilers are taken fr the *Vixen's* steam log, kept during a passage from Pensacola to K West, Florida. On this passage both Cumberland bituminous and thracite coals were used. In both cases, the conditions of wind and remained sensibly the same; the wind and swell were moderate, a abeam. The boilers being nearly new, were clean and free from incr tation.

The Cumberland bituminous was used for the first half of the passa and the anthracite for the last half, with natural draft in both cases.

PERFORMANCE WITH THE CUMBERLAND.

Mean speed of vessel per hour, 6·64 knots; double strokes of pis per minute, 15·675; vacuum in condenser per gauge 26 inches of m cury; steam pressure in boiler per square inch above atmosphere, 14· pounds, cut off at 36 inches from commencement of stroke of pist pounds of coal consumed per hour, 676; sail used half the time.

PERFORMANCE WITH THE ANTHRACITE.

Mean speed of vessel per hour 5·95 knots. Double strokes of piston minute 14·88; vacuum in condenser per guage 26 in. of mercury. Ste

pressure in boiler per square inch above atmosphere 14·75 pounds; cut off at 36 inches from commencement of stroke of piston. Pounds of coal consumed per hour 713. Sail used one-third the time.

It was extremely difficult to keep steam with anthracite after the first 24 hours; with Cumberland coal, steam was kept more easily, but after three or four days continuous steaming with it, the spaces between the tubes would choke up, and so impair the draft as to render it necessary to stop the engines, draw the fires, cool the boiler, and clean out the tube spaces.

During an attempt made to steam from Pensacola to New Orleans with Pittsburg bituminous coal, the tube spaces choked completely up in 24 hours, so as to wholly destroy the draft, the flame rushing out into the fire room whenever the doors were opened, and the vessel put back to Pensacola, reaching port with difficulty.

With these boilers, there is required about an hour and a quarter to raise steam from sea water of Gulf temperature, say 60° F.

Calculating the evaporation by the Cumberland coal in the same manner as before, there results an evaporation of 5·237 pounds of sea water per pound of coal per hour, and 3·248 pounds of sea water per square foot of heating surface per hour.

Proceeding in the same manner with the anthracite, there results an evaporation of 4·713 pounds of sea water per pound of coal per hour, and 2·729 pounds of sea water per square foot of heating surface per hour.

Montgomery Boilers.—Two of iron, placed one on each side the engine.

Length of each boiler,	13 feet 9 inches.
Breadth "	5 " 6 "
Height "	7 " 9 "
Cubic contents of circumscribing parallelopipedon of each boiler,	586·09 cubic feet.
Area of the grate surface in the two boilers,	53·60 square feet.
" heating " "	1090·00 "
Capacity of steam room in boilers,	390·00 cubic feet.
" " " and steam pipes,	425·00 "
Cross area of side flue, both boilers,	7·56 square feet.
" spaces between tubes above division plate or diaphragm (both boilers),	7·64 "
" " " below, " "	7·03 "
" smoke chimney,	8·73 "
Height of smoke chimney above grate,	48 feet.
Mean pressure of steam above atmosphere per square inch in boiler, with Cumberland coal,	14·67 pounds.
Initial pressure of steam above atmosphere per square inch in cylinder with Cumberland coal,	12·47 "
Cutting off at, from commencement of stroke of piston,	3 feet.
Double strokes of piston per minute, with Cumberland coal,	15·675
Consumption of Cumberland coal per hour with natural draft,	676 pounds.
Mean pressure of steam above atmosphere per square inch in boiler, with anthracite,	14·75 "
Initial pressure of steam above atmosphere per square inch in cylinder,	12·55 "
Cutting off at, from commencement of stroke of piston,	3 feet.
Double strokes of piston per minute with anthracite,	14·88
Consumption of anthracite per hour with natural draft,	713.

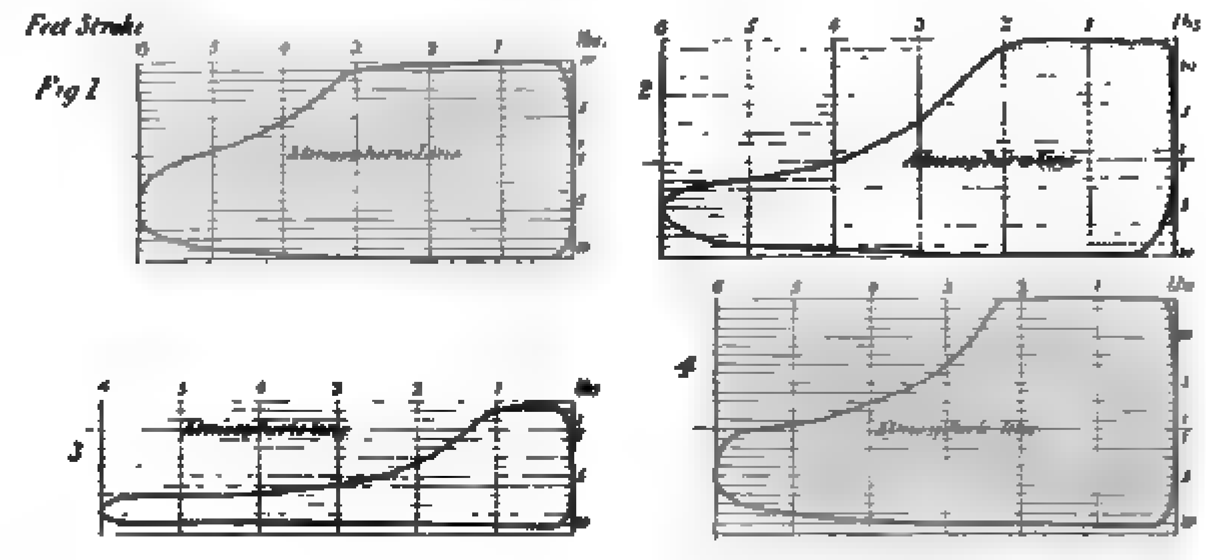
Proportions.

Proportion of heating to grate surface,	20·336 to 1·000
" grate surface to cross area of side flue,	7.090 "
" " " spaces between tubes above diaphragm,	7·016 "
" " " below "	7·624 "

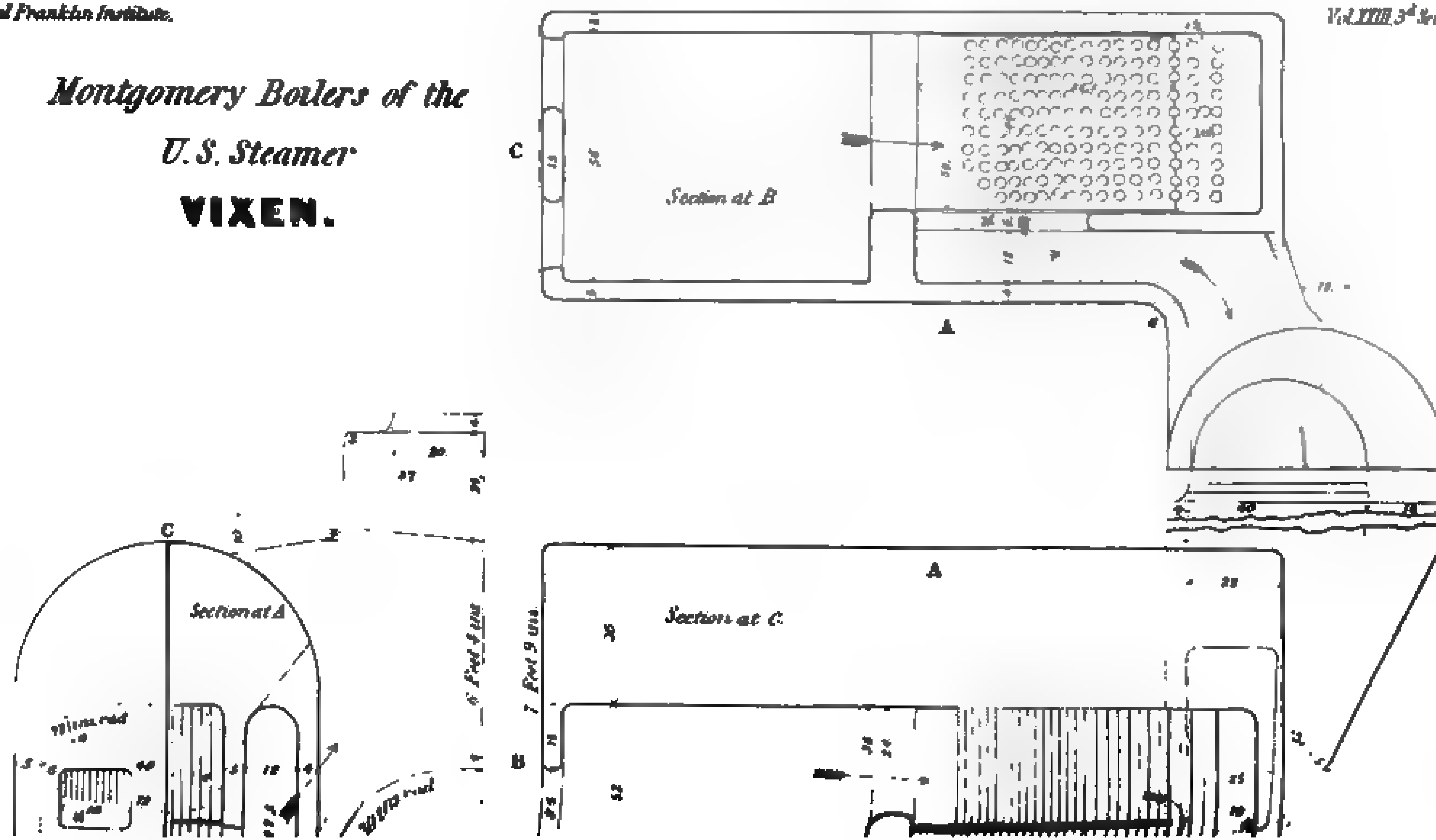
Proportion of grate surface to cross area of smoke chimney,	6·126 to
" heating surface to cross area of side flue,	144·180
" " " spaces between tubes above diaphragm,	142·670
" " " below "	155·050
" " " of smoke chimney,	124·857
" " per cubic foot of space displacement of piston,	25·699 sq
" " " " per double stroke per minute, taking the mean of the double strokes, with bituminous and anthracite coals, viz. 15·28 per minute, ...	1·682
Proportion of grate surface per cubic foot of space displacement of piston per double stroke per minute, . .	0·083
Proportion of grate surface per cubic foot of space displacement of piston, ...	1·264
Proportion of steam room per cubic foot of steam used per stroke of piston, ...	16·865 cu
Consumption of bituminous coal with natural draft per square foot of grate surface per hour,	12·600 po
" " heating " "	0·620
Sea water evaporated with bituminous coal by one square foot of heating surface per hour,	3·248
" " by 1 pound of bituminous coal per hour,	5·237
Consumption of anthracite coal with natural draft per square foot of grate surface per hour,	13·300
" " heating " "	0·658
Sea water evaporated with anthracite by one square foot of heating surface per hour, .	2·729
" " by one pound of anthracite per hour,	4·713

From the foregoing data, it will be perceived that the economi fect from the bituminous exceeded that from the anthracite by 11 cent. of the latter, although the results from both kinds of coal ai The cause of this is undoubtedly to be found in the proportions boiler. The proportion of least calorimeter or area of draft is but to 7·016 of the grate surface, with a chimney only 48 feet high ab grate, and there was burned on each square foot of grate 12·6 an pounds of coal. This calorimeter was entirely too small to furn necessary supply of atmospheric air for even the bituminous, mu for the anthracite, which, containing more of the carbon and less hydrogen constituent, requires a much greater amount of air for quantities of the coals. According to Prof. Walter R..Johnson, a of Cumberland bituminous coal requires for its combustion, 237·2 feet of air at the standard temperature of 60° F., and 30 inches barometer; while the combustion of a pound of anthracite requires cubic feet of the same air, or $30\frac{3}{10}$th per cent. more than the There was thus not only this greater amount of air required for thracite, but there was a much less velocity of draft to furnish it the anthracite evaporated a less quantity of water than the bitun (equal weights of each,) and as the amounts of the two kinds burned in equal times may be considered practically the same, the ence being but $5\frac{3}{10}$th per cent. of the greater quantity, there w heat present in the flues during the combustion of the anthraci consequently a less draft. Had the proportions of the boiler been for the combustion of anthracite, it would doubtless have given t *perior* result due to it theoretically, and obtained elsewhere prac

Original Boilers of the U.S. Steamer VIXEN.



Montgomery Boilers of the U.S. Steamer VIXEN.



ıere proper conditions have been observed. With this greater deficiency air for the anthracite than for the bituminous, a proportionally larger ıount of the carbon constituent in the fuel went off in the form of :bonic oxide, instead of carbonic acid gas.

COMPARISON OF THE ORIGINAL WITH THE "MONTGOMERY" BOILERS.

The two kinds of boiler would supply equal amounts of steam in equal nes, until the "Montgomery" choked up; while no choking up was :perienced with the original boilers.

	Original Boilers.	Montgomery Boilers.		
ubic contents of circumscribing parallelopipedon, ...	1422$\frac{3}{4}$ cu. ft.	1172.18 cu. ft.	or as 1.214 to 1.	
rea of grate surface, ...	47 sq. ft.	53·60 sq. ft.	" 0·877	"
rea of heating surface, . .	750 "	1090·00 "	" 0·688	"
rea of least calorimeter, proportionally to grate surface, . . .	7·457	7·624	" 0·978	"
eight of chimnies above grates, .	43$\frac{3}{4}$ feet.	48 feet.	" 0·912	"
ounds of bituminous coal burned per hour per square foot of grate, . .	12 pounds.	12·600 pounds	" 0.952	"
oportion of heating to grate surface,	15·958 to 1.	20·336 to 1.	" 0·784	"
unds of sea water evaporated per hour rom 100° F. by 1 lb. bituminous coal,	4·107 pounds.	5·237 pounds	" 0·784	"
unds of sea water evaporated per hour y one square foot of heating surface,	3·089 "	3·248 "	" 0·951	"

Although the above figures show an economical evaporation in favor of : Montgomery boilers, in the proportion of 1·000 to 0·784, both burn- ; bituminous coal, yet it must be remembered that with the original ilers, the bituminous was the Pittsburg variety, while with the Mont- mery boilers, the bituminous was the Cumberland variety. Turning the carefully conducted experiments of Prof. Walter R. Johnson, made the government expense on various coals, I find the evaporation of sh water from a temperature of 212° F., by one pound of Cumberland uminous coal, to be 9·98 pounds, and by one pound of Pittsburg bitu- nous coal, to be 8·20 pounds, or the evaporative effects of the two ıls compare as 1·000 to 0·821, or differing but $3\frac{7}{10}$th per cent. from the ative evaporation obtained in the *Vixen's* boilers.

Making the necessary allowance then, for the different evaporative wers of the different coals used, and for the fact of the one boiler being . and foul, and the other new and clean, there appears to be no supe- rity due to either *type* of boilers considered as such.

The indicator diagrams were taken during the performance of the ntgomery boilers, and are added to show the action of the cylinder ves, cut-off, &c.

INDICATOR DIAGRAMS FROM THE STEAM CYLINDER.

'ıg. 1. Plate III.—Steam, per gauge in boiler, 12 lbs.; vacuum, per gauge in condenser, in.; double strokes of piston per minute, 17; mean effective pressure per square inch, } lbs.; throttle wide.

'ıg. 2.—Steam, per gauge in boiler, 15 lbs.; vacuum, per gauge in condenser, 24 in.; ble strokes of piston per minute, 16; mean effective pressure per square inch, 14$\frac{1}{4}$ lbs.; ttle wide.

'ıg. 3.—Steam, per gauge in boiler, 5 lbs.; vacuum, per gauge in condenser, 25 in.; ble strokes of piston per minute, 9; mean effective pressure per square inch, 5·6 lbs.; ttle close shut.

'ıg. 4.—Steam, per gauge in boiler, 16$\frac{1}{2}$ lbs.; vacuum, per gauge in condenser, 24 in.; ble strokes of piston per minute, 14; mean effective pressure per square inch, 15 lbs.; ttle wide.

On Marine Propulsion. A Reply to J. W. Nystrom, Esq. *By* J. V. Merrick.

The reply of Mr. Nystrom to my remarks in the January number, presents so clear a case of misapprehension in the first principles of dynamics, that I think it will not be difficult, by reference to any treatise on that subject, to prove his positions entirely untenable.

Those positions, as nearly as I can understand them, are—1st, That there is some grand difference between the action of propellers and paddle-wheels, in virtue of which the revolutions of a screw may be considerably increased without altering the slip, while such a result cannot be expected when a paddle-wheel is employed; and, 2d, That "slip" is not a measure of loss of effect.

Let us examine the subject in detail. The effect of a constant force is composed, 1st, of the intensity of its effort, and 2d, of the space passed through; and consequently, its effect in a given time is the product of its intensity and its velocity. This effect has received from different authors various names, of which the "quantity of work" appears to be the most expressive.

It follows from this definition, that when no velocity is obtained, or in other words, when a body in which a force acts is immovable, there is no "work" expended; and it follows also, that if a constant force is acting to separate two bodies, its intensity of effort, which may be called its resistance or pressure, will act equally on each body, and the quantity of work expended on each, will be expressed by the product of this intensity, or resistance, or pressure, and of the velocity maintained by each; and that the sum of these products must always equal that of the original pressure or intensity of effort, and of its velocity.

Now, suppose the case of a locomotive moving upon a railway; the driving wheel may be considered as a lever, through which the power developed by the engine is transmitted to the rail, each point of which, as the moving driving wheel comes in contact therewith, forms the point d'appui against which acts the power of the engine to propel itself and train; and if this power be equivalent to a weight of 100 pounds constantly acting at the velocity of the circumference of the driving wheel, then if the friction or "hold" upon the rail just equals 100 pounds, the wheels will turn without slipping upon the rail; in this case, the velocity of the train in a unit of time, multiplied by the resistance it offers to motion at that velocity, just equals the whole available power of the engine in that time. But if the power developed by the engine be increased by the employment of larger cylinders with the same steam pressure, this power transmitted to the circumference of the driving wheel will be increased either in intensity or in velocity. As, however, the friction was before just equal to the resistance offered by the train at its former velocity, and as the pressure can never exceed the friction or resisting pressure, the increase must take place in the velocity. But the velocity of the train cannot be increased, because it requires a pressure equal to the friction, to give it that velocity. Hence the circumference of the driving wheel must revolve faster than the engine can advance,

or in other words, must slip upon the rail. The ratio of this "slip" to the velocity of the driving wheel, is the per centage employed in what may be called *propelling the friction backwards*, which is non-utilized effect.

In the case of a paddle-wheel steamer, supposing there is no oblique action, and that the whole area of the float is concentrated at the centre of effort, the rail is replaced by the water, and the friction of the rail by the power required to put in motion that water. Now as water is a body whose particles are free to move upon one another, it follows that no pressure can be applied to it without producing motion; hence the power transmitted to the centre of effort revolving at a certain velocity, must not only give rise to a forward motion of the vessel, but to a retrograde movement of the water, called "slip;" and by the law of dynamics, previously mentioned, the available power of the engines when uniform motion is attained, will therefore be divided as follows: 1st, the pressure at the centre of the float will give rise to a certain velocity of the vessel, dependent on its form and dimensions, the product of which, by this pressure, expresses that portion of the power expended in propelling the vessel, and is called "utilized effect;" 2d, the same pressure at the centre of the float, will give rise to a certain velocity of the water, in a sense opposite to that of the vessel's motion, dependent on the form, dimensions, and arrangement of the floats on the wheel, which velocity multiplied by the said pressure, expresses that portion of the power employed in propelling the water backward, and is called "non-utilized effect." As the same pressure is an element in both these expressions, and as the sum of the two effects must be equivalent to the available power of the engines, it is obvious that the sum of the two velocities is equal to that of the centre of pressure of the float, and that the ratio of non-utilized effect to the whole power available, is measured by that of the velocity of the slip to the velocity of the wheel.

If this be not clear enough, the case may be stated in another way. Suppose a paddle-wheel steamer to be tied to a wharf, her engines to be in uniform motion, and steam of a given pressure to be admitted freely to the cylinders. Then, according to the relative velocities of the wheel and the crank pins, this power becomes at the centre of effort of the former, equivalent to a certain velocity multiplied by a certain pressure, which is capable of giving a certain velocity to the water put in motion by the floats, depending on their form, arrangement, and dimensions. Here the whole effect of the engine transmitted through the shafts, is non-utilized in propelling, because the vessel has no velocity. If, now, the engines being still working with the same steam pressure, the vessel be untied, after the first instant of time, if we can suppose uniform motion to be attained during an indefinitely short period, the retrograde velocity of the water will have been diminished, that of the vessel (forward) increased, (since it was before $= 0$,) and that of the engines increased, thereby augmenting the *power* developed, although the *pressure* remains precisely the same as before. At the end of successive instants of time, the same effects will be exaggerated, the *pressure* always remaining the same, until an absolute uniformity of motion is attained; when it will be found that the opposing resistances are in equilibrium

(not the opposing *effects*,) and that the resistance of the water thrown back by the wheels, is precisely equal to the resistance opposed by the water and air to the advance of the vessel. And then, the ratio of the coefficient* of the vessel, and of the area of the floats brought into action while the vessel goes over an unit of space, multiplied by the coefficient for resistance to plane surfaces at the given immersion, determines (inversely) that of the velocity of the vessel, forward, to the velocity of the water backward.

For example, if the coefficient of a vessel be 40, and the area in feet of the propelling surface of the floats, acting while the vessel advances through a unit of space, $= 240$, then the slip should be $\frac{40}{240 + 40} = \frac{40}{280} = \frac{1}{7}$ or 14 per cent., nearly.

The same principles must govern us in the consideration of the screw propeller. Suppose, as before, that a screw vessel is tied to the wharf, and steam of a given pressure freely admitted to the pistons, which are in uniform motion; then the power developed, after the requisite deductions are made, is transmitted through the shaft, and according to the ratio of velocities of the pitch of the screw, and of the crank pins, becomes at its centre of effort, a certain pressure exerted in the direction of the axis, which pressure is capable of giving a certain velocity to the water put in motion by the propeller blades, depending on their form, arrangement, and dimensions. Here the whole available power of the engines is non-utilized effect, since the vessel has no velocity. If, now, the vessel be untied, and if after the first instant of time we suppose uniform motion to be attained for an indefinitely short period, the retrograde velocity of the water will have been diminished, the forward velocity of the vessel increased (since it was before $= 0$,) and that of the engines increased, thereby augmenting the power developed in a given time, though the *pressure* on the propeller remains the same. At each successive instant of time, the same effects will have been exaggerated, until at length uniform motion will be attained, when it will be found that the opposing *pressures* are in equilibrium, or in other words, that the resistance of the water thrown back by the propeller, is precisely equal to the resistance opposed by the water and air to the forward motion of the vessel; and that the ratio of the coefficient of the vessel to the projected area (in square feet) of the blades acting while the vessel passes through an unit of space, multiplied by the coefficient resistance per square foot to a plane surface, will be inversely that of the relative velocities of the vessel and of the water in opposite directions.

For example, in the case of the San Jacinto, the pressure required to propel her at a velocity of $\frac{968}{60} = 16{\cdot}11$ feet per second, was (by dynamometer) 12,815 pounds. Hence her coefficient was $\frac{12{,}815}{16{\cdot}11^2} = 49.3$.

* By the "coefficient" of a vessel, I mean that number which, multiplied by the square of its velocity, and by the mass of a cubic foot of water, equals the number of pounds *required to* propel her at that velocity; for sea water the mass $= \frac{P}{2g} = \frac{64{\cdot}5}{64{\cdot}33}$ or *1·, nearly.*

the area of her propeller blades projected on a plane perpendicular to the axis, is 108·5 sq. feet. But the projected area acting to propel, while the vessel is advancing over a unit of space, is (as I shall hereafter show,) equal to that of the propeller, in rest, multiplied *by the secant of the angle, whose tangent multiplied by the circumference, is the advance of the vessel during a revolution.*

The coefficient of plane surfaces propelled through liquids, is various at different speeds, and under different circumstances. Beaufoy, in one set of experiments, found it to be for water (near the surface) 1·08; and in another set, 1·12. (Theoretically it should be $\frac{P}{2g} = \frac{64{\cdot}50}{64{\cdot}33} = 1$, nearly, for sea water; P being the weight of a cubic foot,) and it of course varies with the immersion. As we are now viewing the theory of the screw, however, and cannot ascertain its value within the limits of 1· and 1·12, we shall assume it = 1·00, which will be near enough for the purpose.

At twenty-five per cent. slip of the San Jacinto's propeller, the secant of the angle before mentioned, which is $\frac{(\text{circ.})^2+(\text{advance})^2}{(\text{circ.})^2} = 1{\cdot}40$, so that its acting area was $108{\cdot}5 \times 1{\cdot}40 = 151{\cdot}9$ square feet. Hence the slip should be $\frac{49{\cdot}3}{151{\cdot}9 + 49{\cdot}3} = 24{\cdot}5$ per cent., while the slip observed $= 26{\cdot}27$ per cent.; while the velocity of pitch if this were the correct slip would be $16{\cdot}11 \left(1 + \frac{24{\cdot}5}{100-24{\cdot}5}\right) = 21{\cdot}33$ feet per second. This is as near a result as calculation will give, when it is considered that a part of the blades near the axis were probably not efficient, or that from disturbing influences, the coefficient was less than 1. If for example, it were ·911, then $\frac{49{\cdot}3}{(151{\cdot}9 \times 911) + 49{\cdot}3} = 26{\cdot}27$ per cent.

Enough has, I think, been said, to show that *the pressure constantly exerted by a screw propeller or side wheel, always remains the same with a given pressure in the cylinders, and is entirely* independent of the velocity at which the vessel moves. Hence in the case of the tow-boat, (adduced by Mr. N.,) the *pressure* exerted by her propeller or wheel, is always the same with the same steam pressure, no matter what number of vessels she may have in tow; and the effect utilized, would therefore be always in exact ratio with the difference between unity and the per centage of slip, provided the acting area of the propeller was the same. Let us suppose as an example, that the San Jacinto should take in tow another vessel possessing the same coefficient, and that steam of the same pressure as before, be admitted to her engines. The sum of the coefficients would then be $49{\cdot}3 \times 2 = 98{\cdot}6$. Then the velocity at which the vessels would move, would be $\sqrt{\frac{12815}{98{\cdot}6}} = 11{\cdot}4$ feet per second. In order to approximate the acting area of the propeller, suppose the slip to be 41 per cent., then secant $\gt = 1{\cdot}28$, and $108{\cdot}5 \times 1{\cdot}28 = 139$ feet.

Hence slip $= \dfrac{98{\cdot}6}{139 + 98{\cdot}6} = 41{\cdot}4$ per cent. So that the velocity of the pitch will be $11{\cdot}4\left(1 + \dfrac{41{\cdot}4}{100-41{\cdot}4}\right) = 19{\cdot}47$ feet per second. Hence the powers developed by the engine will be in the two cases, as 21·3… to 19·47, or as 1· to ·913, while the utilized effects produced, are as $(16{\cdot}11)^3$ to $(11{\cdot}4)^3 \times 2$, or as 1 to ·709. In like manner, we may find for the cases, when two such vessels are towed, a slip of 53·2 per cent.

"	three	"	"	"	" 61·0	"
"	four	"	"	"	" 67·4	"
"	five	"	"	"	" 71·8	"
"	six	"	"	"	" 75·0	"

The acting area of a screw has been supposed by some authors to be the projected area of all its blades on a plane perpendicular to the axis by others, to be their absolute area, on the supposition that their action is perpendicular to the surface; by others, again, the area of the circumscribing circle. It appears to me, however, to be neither of these; but the projected area by the ratio of length between the helicoidal path traversed by the centre of effort, and the circumference of the circle in which it moves; and for the following reason: the coefficient of a vessel (before alluded to) represents the area of a plane, whose resistance would be equivalent to that of the vessel; consequently the quantity of water which may be said to be displaced by the vessel, is that which would be displaced by this plane, or is equivalent to the product of its area and of its advance. Now the water displaced by the blade of a screw, is a volume whose area is that of the helicoidal path traversed by the whole blade, and whose length is the slip; with the velocities of these two displacements, we have nothing to do; we have simply to compare the "acting area" of the blades, and the "propelled area," as it may be styled, or coefficient of the vessel; and as the area of the helicoidal path of the whole blade is to its projected area on a plane perpendicular to the axis of the screw, as the secant of the angle it forms with that plane is to unity, it results that the product of this projected area by the secant of this angle, is the "acting area" of the blades. Or, it may be thus stated each point in the surface comes in contact with, and therefore sets in motion, every particle of water it glides over during its revolution, and as the aggregate of all these particles forms the helicoidal line traced by the blade, it is clear that a body of water is moved during its revolution by that point, proportional to the length of that line. Now if the vessel have no motion, this helicoidal line becomes the circumference of the circle in which it moves; and if the vessel have any forward movement the angle formed by the helicoidal path over which the centre of effort passes, is such that its tangent, multiplied by the circumferential movement, equals the advance; and it is this angle whose secant forms the multiplier for the projected surface of all the blades, to obtain their acting area. It thence follows that this area diminishes as the slip increases, of course diminishing the resistance requisite to put the water in motion.

With a paddle-wheel, the reverse is the case; there the number of floats immersed during the advance of the vessel over a unit of space

increases with the slip. For example, if a paddle-wheel have 30 floats, and if 20 revolutions cause its centre of effort to move over 1000 feet, and its propelling area = area of floats immersed, $\times \frac{30 \times 20}{1000} = \cdot 60$ N.; then if the vessel advances over only 900 feet, (or if the slip is ten per cent.,) the number of floats immersed during its passage over 1 foot, would be $\frac{30 \times 20}{900} = \cdot 67$ N.; if over 800 feet, with 20 per cent. slip, $\frac{30 \times 20}{800} = \cdot 75$ N., and so on in the ratio of $\frac{1}{1-S}$, and as the volume of water set in motion is equal to its area multiplied by the recession of the water, while that of the water displaced by the vessel, is equal in value to the area expressed by its coefficient multiplied by its advance; and inasmuch as we have nothing to do with the *velocities* with which either volume is moved, we have to compare the acting and propelled areas, which in this instance approach in value as the slip diminishes.

Such are the indications of theory; but it is found that the values given by them, are but approximative, and that there are some modifying circumstances experienced in practice. Among others, may be noticed the fact, that as propelling surfaces approach more nearly to each other, or follow each other more rapidly, the disturbance of the water diminishes their efficiency; that water impinging on surfaces at more oblique angles, increases its pressure more rapidly than is justly due to its velocity, and that consequently, it opposes greater resistance to surfaces striking it at very acute angles; that the lines of a vessel astern, have great influence on the resistance offered to its propeller by the greater or less facility with which the water falls into the wake; that the coefficient of a vessel increases at high rates of speed, &c., &c. The great principle, however, remains the same, viz: that *slip* with the same relative propelling area and coefficient, *is a measure of loss of effect*, and that in all propelling agents (now known), the change in propelling area at different slips within the ordinary limits, when taken in connexion with the different resistances offered by the water under these different circumstances, is not so great as materially to affect this condition in practice.

And now for a notice of some of Mr. Nystrom's observations. In the first place, when quoting my remark, that "heavy weather at sea" is apt to increase slip; he adds, "we may as well say a good fair wind, which then would decrease the slip; these are the results of circumstances." What has been said will show that the "circumstances" are generally on one side of the question, and that while a very moderate increase of resistance increases slip, it requires a far greater force to equally diminish it. In fact, the experience of all screw steamers is, that the average slip during an ordinary voyage, is greater than that attained under the favorable circumstances of smooth sea and calm. In the next place, it is unnecessary to recapitulate in order to show that the same general principles cover the case both of paddle-wheels and propellers, when it is a question if velocity can be increased with the same resistance and slip. 3d, Mr. N. says, that "if we suppose the slip to be 100· (that is, when the vessel

stands stationary, and the propeller is running,) and the slip is a measur of the loss of effect as described by Mr. Isherwood, then the slip shoul take away *all the effect* from the steam engine, and not allow any for th friction and working the pumps." Now these latter elements hav nothing to do with the question; they are absorbed and utilized befo the power developed by the cylinders reaches the shaft; consequentl are not transmitted to the propeller, and do not form a part of the tot power in which the per centage of loss is calculated. If, for instanc a power of 100 horse power be developed, and it require 10 horse pow to overcome friction, &c., it is but 90 horse power which is transmitte to the propeller. Again, with reference to the tow-boat question.

"Again, let us take a few steps back, and suppose the slip to be 80 per cent., which often the case with tow boats; then, if the loss of effect is 80 per cent., there is only 2 per cent. left, which is nothing more than what is required for the friction and workin the pumps, consequently nothing left as useful effect for towing; still the vessel is runnin and in this age of common sense, we do not believe that witchcraft tows the vessel; tak the same tow boat to tow a smaller vessel, which causes a slip of only 50 per cent.; th friction and working the pumps being the same, 20 per cent., then there remains 30 p cent., as useful effect for towing. We see now that if slip is a measure of loss of effec it requires more power to propel a small vessel, and no power to propel the largest vessel.

Here we find the same error as in the former case—the whole stru ture of the argument is built upon sand. Again, in reference to th comparison of a locomotive with a steam vessel, it is intimated that if w "try the experiment with a locomotive in water, we shall find it run a well without wheels." Undoubtedly; it would probably sink—but i that difficulty were overcome, it would advance quite as rapidly as the finest screw vessel, if drawn upon shore, and her engines were driven at full power. The comparison is entirely irrelevant—as much so as to assert that a man exercised no power in walking, because, if suspended in the air, he could not advance by the same movements of his limbs.

Finally, The calculation into which Mr. N. enters at the conclusion of his article, is a lamentable instance of implicit faith (without examination) in the old doctrine that "action and re-action are equal and in opposite directions;"—a form of expression which ought never to be quoted or used without the substitution of the proper terms, "pressure and resistance" for "action and re-action."

The very first equation given in that calculation is erroneous—it should have been $p=r$;—consequently the results attained by it are valueless.

It is unnecessary to quote or reply at greater length, although the question is by no means exhausted—and with any persevering reader who may not have "dropped off" ere this, I shall rest what I believe to be a "clear case."

For the Journal of the Franklin Institute.

Description of the Steamer "City of Norfolk."

This steamer, constructed in Baltimore, has been recently put on the New York and Richmond line. She was built for Messrs. Mailler & Lord, of New York, Agents and part owners.

HULL—Bell & Brothers, Builders.

Length between perpendiculars, . 165 feet.
" on deck, ... 180 "
Breadth of beam, ... 27 "
Depth of hold, ... 17 " 3 inches.
Midship section immersed at trial, 240·67 sq. ft.
Tonnage: Register, 571 tons; Carpenter's measure, 729 tons.
Rig, 3 masts; fore and aft sails.

ENGINES—By Murray & Hazlehurst, Vulcan Works.

Cylinders—two: inverted, direct action, and connexion.
Diameter, . . . 2 feet 8 inches.
Length of stroke, . . 2 feet 8 inches.
One Air-Pump, solid piston, double acting, driven by beam and connecting rod from main crank shaft.

SCREW—Of Cast Iron.

Diameter, . . . 9 feet 2 inches.
Pitch, (expanding,) . { 15 feet 6 inches at entrance. / 19 feet at exit. }
3 Blades; absolute width at periphery, 4 feet 9 inches.
" at hub, 1 foot 6 inches.
Fore shortened view on disk, at periphery, 4 feet 1 inch.
" " " at hub, 6 inches.
Absolute area of all blades, . . 44·6 sq. ft.
Projected " " . . . 24·7 sq. ft.
Thickness at periphery, . . . $\frac{5}{8}$ inches.
" at hub, ... 4 inches.

BOILERS—Two: flue and return tubular.

External dimensions—width 8 feet; length 18 feet 2 inches.
Heating surface, both boilers, 1824 sq. feet.
Grate " " " 44 sq. feet, or in the ratio of 21·71 to 1·00. Each boiler contains 2 flues 18½ inches, 2 flues 14½ inches, and 2 flues 10½ inches diameter, 8 feet 2 inches long, and 75 tubes 4 inches diameter, 6½ feet long, the upper tubes on a level with crown of furnace.
Collective area, both boilers, of flues, 14·44 sq. feet.
" " " of tubes, 15·70 sq. feet.
Ratio to grate surface of flues, . . $\frac{1}{5\cdot 82}$
" " " of tubes, . . $\frac{1}{5\cdot 35}$
Chimney, 56 inches diameter, or area 17·1 sq. feet, and 55 feet high above grate bars.

Performance in the Bay on first trip from Baltimore to New York.

Revolutions averaged 60 per minute.
Steam averaged 20 to 22 lbs., cutting off at half stroke.
Speed averaged 10·22 miles per hour, as follows:
Time 6 hours 39 minutes.
Distance run 68 miles, by United States Coast Survey Charts.
Draft of Water—Forward, 10 feet 4 inches.
" " Aft, 12 feet 6 inches.
Ship very deep, and drawing too much by the stern.

Fuel—Consumption not accurately ascertained, but estimated pounds per hour.

Slip—Mean pitch $=\frac{19+15\cdot5}{2}=17\cdot25$ feet. The velocity nc pitch was $17\cdot25\times60\times60=62{,}100$ feet$=11\cdot76$ miles per hour.

Slip, therefore, $=\frac{11\cdot76-10\cdot23}{11\cdot76}=13$ per cent., a very excellen

---

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin I Session, 1850–51. *By* Dr. L. Turnbull.

Continued from page 191.

The Electric Telegraph between England and France. Extension to and Belgium.

The first wires for the Submarine Telegraph were sunk in the channel on the 27th of August, 1850. The wire was thirty mile with a covering of gutta percha half an inch in diameter, the w bedded by leaden clamps of twenty and twenty-five pounds, to the of the sea; the clamps were streamed out at every sixteenth of a m the wire was safely sunk to a depth which was hoped would plac of the reach of anchors or monsters of the deep; and the other enc wire was run up the cliff at Cape Grinez, to its terminal station French side of the channel, and messages were passed between t countries.

But unfortunately for the first effort, in the course of a mon wire received so much injury on a rock off Cape Grinez, as to it entirely useless, and upon a careful consideration, the Directors Company determined to lay, instead of one, "four permanent wir

Upon an examination by divers, it has been found that wh rupture of the coil occurred, it had rested on a very sharp ridge of about a mile out from Cape Grinez, so that the leaden weights, h pannier-like on either side, in conjunction with the swaying of the caused it to part at that point; while at another place, in sho shingle from the beach had the effect of detaching the coil fr leaden conductor that carried it up the Cape.

The wire, in its gutta percha coating, was consequently cut places, representing a remnant of wire of about four hundred which was allowed to drift away, till it came into the possessi fisherman of Boulogne; and it was no wonder that it was cut represented as not thicker than a lady's stay-lace, while it ought t been as thick as the cable of those placed in the Britannia tubes i tion, say eight or ten inch cable, and to be submerged below five fa by the aid of enormous weights, so as to avoid all currents.

In the *London Mining Journal* for November, 1850, Mr. J. J. of the Ordnance Office, Plymouth, proposes, in order to prevent *to the* telegraphic wires, from the nature of the bottom, to suspen

by corks placed at intervals, and to secure them to the bottom by anchors or a dead weight, at certain greater distances, and at each anchor, or weight, a small buoy, with a flag, could be secured, which would indicate their locality; and in the event of accident, they could readily be found.

I will now state the present condition of this communication, and the means taken to secure it from accident; and I will then describe the form of telegraph which is employed by Mr. Brett. In *L'illustration Journal Universel,* for October, 1851, it is stated that in this, the last effort, they had not calculated for the proper amount of cable, when first taken across the channel, it requiring a mile more cable, but the accident was soon repaired. The engraving is one taken from that Journal, and they remark that it is indeed a wonderful work. The cable of wire in which is enclosed the electrical conductor, was manufactured in the short space of three weeks, by means of a machine, the invention of Mr. Fenwick, an ingenious English engineer. It is hoped, that to preserve the conducting wire free from accidents which caused the first experiment to fail, by the present arrangement four wires are enveloped in a double cover of gutta percha, and each re-covered with cable lying at the bottom of the sea. The covers forming, together, a length of ninety-six miles, over which is placed a linen covering prepared in a composition of tar, tallow, &c., and crossing its length the centre of the cable.

Fig. 54.

No. 1, fig. 54, is the first covering of gutta percha; No. 2, is the second covering, re-covering the first; No. 3, section of the covering No. 2; No. 4, is the wire in the covering of tarred linen; No. 5, is the simple wire of galvanized iron; the covering is that of zinc; No. 6, is a view of the arrangement of the cable, showing the galvanized iron wire, &c.

To recapitulate:—The rope is 24 miles long, and consists of four copper wires, through which the electric current will pass, insulated by coverings of gutta percha. These are formed into a strand, and bound round with spun yarn, forming a core or centre, round which are laid ten iron galvanized wires of 5-16ths of an inch diameter, each welded

into one length of 24½ miles, and weighing about fifteen tons. The ro weighs, altogether, about 180 tons; it forms a coil of 30 feet in diamet outside, 15 feet inside, and five feet high, and was in good working orc in September, 1851. English papers received by the arrival of t Niagara, on Friday, December 12th, 1851, state that the Sub-mari Telegraph is working well. Messages on the same day have been tra mitted from London and Liverpool to Paris, Havre, Vienna, Tries Hamburg and Ostend; and in one instance, a communication was fo warded to Cracow, to be despatched thence by mail to Odessa.

The rates are, for a message of twenty words:—

From Paris to Calais.	7f. 56c.
" " Dover, ...	19f. 56c.
" " London, ...	32f. 81c.
" " Birmingham, ...	—— ——

From Paris to Brighton, Cheltenham, Coventry, Gloucester, Ne Market, Norwich, Oxford, Portsmouth, Southampton, &c., 26f. 03c.

From Paris to Chester, Edinburgh, Glasgow, Holyhead, Liverpo Manchester, New Castle, Nottingham, Sheffield, York, 29f. 31c.

Now that the English channel has been crossed in so substantial a ma ner, and with such perfect success, the crossing of the Irish channel mu follow; for the same Company will perform this important work.

By their act of incorporation they are styled "The Submarine Telegra Company between England and France, between England and Irelan and the European and American Printing Telegraph," all proposed by M Jacob Brett, in 1851.

Messrs. Carmichael & Brett have contracted with the Belgian Gover ment for the formation of a submarine telegraph between Belgium a England. They are to have a monopoly of ten years, and the gover ments are to have priority of all messages.

Description of Brett's Printing Telegraph, Plate IV.

Suppose at one extremity of *a single line* of telegraphic wire, a sm key board, containing a row of ivory keys, marked with the letters the alphabet, and other characters or words; and that it be connected l the said wire to the printing machine at the other extremity. This m chine contains a type wheel, having on its circumference correspondi letters, words, or signs; a slight electric power is sufficient to regula the motion of the whole, so that the instant a key representing any wor letter, or sign, is pressed down by the person at the key board at one en of the line, the corresponding word, letter, or sign of the type whe prints, and the signal bells ring at the other end of the line of telegrap without limit as to distance. The communications are printed on pap supplied from a scroll of unlimited length, from which any portion the correspondence may be cut off at pleasure.

The motive power is simple; it being that of a weight, which sets i motion the key shaft and governor of the key board; and the circu wheel in connexion with the shaft being put in contact with the wire o the galvanic battery, or other generator of electricity, according to th velocity of motion and manipulation at the key board, so will the motio be fast or slow at the printing end of the telegraph; the type wheel of th

BRETT'S
Electric Printing Telegraph

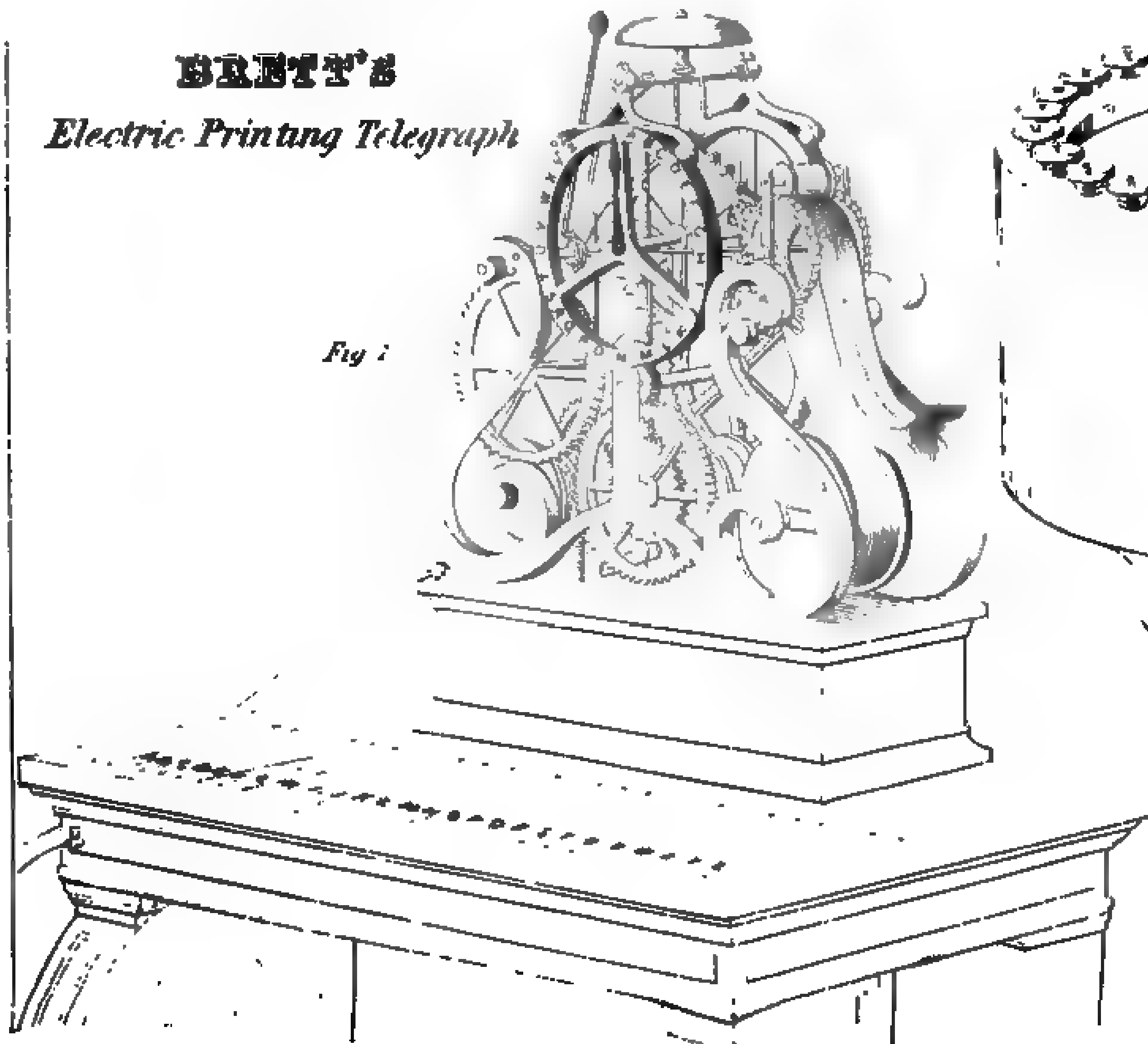


Fig 1

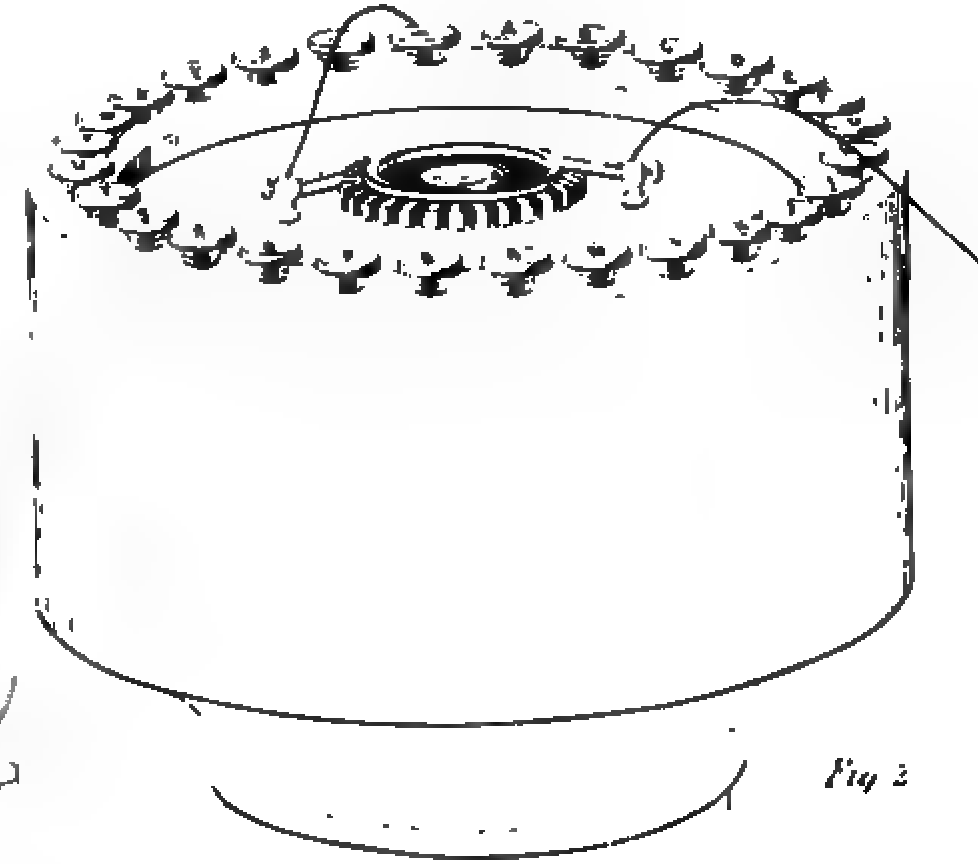


Fig 2

telegraph is set at liberty by means of an escapement, and weights in connexion with it, so as to print with a like velocity, in combination with an hydraulic or pneumatic regulator, which admits of the desired letter *only* being printed, by checking and releasing an eccentric arrangement; a rod from thence unites with the cylinder on which the paper is printed, in various modes, as may be desired, either in paragraphs—on a sheet of paper—upon a long strip of ribbon or paper—or, if for government despatches and the like, it can be printed line by line, like the column of a newspaper, of an unlimited length.

Fig. 2 represents a separate key board, of a circular form, from which communications can be forwarded to any or every station in connexion with it, the letters, words, or characters being arranged round it on the keys; and these, if depressed by the fingers, will check the motion of a pin, or shaft, and also of the circuit wheel fixed to the same axis, at such given point or key, by which means the operator may make or break the circuit of conductors at such letter or point.

The distance actually proved to act by this telegraph in one continuous line has been 230 miles, and 340 miles apart, at the rate of 100 letters per minute. This is a modification of the House Printing Telegraph.

From the year 1847 to that of 1852 there have been so many fancied improvements made in electro-telegraphs, that it is unnecessary to consume time in describing them. The most important I have noticed in full; but in the majority, I have only described a new claim, or a good modification of an old arrangement.

The three most interesting telegraphs which have been devised in that time, are those of Henley & Foster, of England; Siemens, of Berlin, and Allen, of Edinburgh. I have arranged them chronologically, and have given a list of the publications where they may be found, especially in the instances where the description given here is limited.

Nott's Improvement in Electric Telegraph, January 20, 1846.—Novel arrangement of apparatus, by which audible and visible signals can be given, through the agency of electro-magnetism.—Rep. Pat. Inventions, 1847, p. 97.—(Irish.)

Hatcher's Improvements.—First, consisting in arranging and disposing of magnets in such a way that when an electric current is transmitted through them, gives a step by step motion. The second relates to the means of forming the metallic connexions. Third, in regulating a number of clocks.—Patent, dated March 23, 1847.—(English.)

Reid's Electro-Telegraphic Improvements.—Better insulation of the wires, by laying them in channels under ground, and covering them with gutta percha, marine glue, or tar; using a modified galvanometer to sound an alarm, and earthenware insulators.—Patent, dated Nov. 23, 1847.—(English.)

Henry Mapple, Wm. Brown, and James Lodge Mapple, Telegraphic Machine, June, 1847.—They magnetized a steel dial by electricity, and thereby made a steel pointer to move over it.—Rept. Patents, Feb., 1848.

Barlow and Foster's Improvements in Electric Telegraphs, April 27, 1848.—First, coating the telegraphic wires with a compound, consisting of one part by weight of New Zealand gum, and one part of milk of sulphur, added to eight parts of gutta percha, by little and little, while in a

kneading trough, at a temperature of 120° Fahr. The coating is effected as follows:—Two pairs of rollers are made to revolve by means of suitable gearing, at one uniform speed, and each pair is provided with a pipe, fitted steam-tight, to one end of their axis, through which pipe steam is admitted at pleasure, which serves to bring the rollers to a temperature sufficient to soften partially two bands of gutta percha, passed between them. Then, there is another pair of rollers, which have their surfaces cut with semi-circular grooves; the grooves of the one roller corresponding or falling right over those of the other. The wires to be covered are wound upon reels, from which they pass between the second pair of rollers. The bands or fillets of gutta percha are passed between the first pair of rollers, (and are so brought into an adhesive state,) and the two bands of gutta percha, with the wires between them, are in this state passed between the second pair of rollers, by which the fillets of gutta percha are made to adhere together, and consequently to envelope the wires.

2d, The governing the currents of electricity, so as to cause each pulsation thereof, separately or conjoined, to indicate different signs or symbols.

3d, The patentees describe an electric telegraph apparatus for indicating the passing and time of passing of a railway train.

A dial is pierced with fifty holes at regular distances, in which holes small plugs are placed. This dial is made to revolve once every hour. A metal spring presses against the face of the dial, and has the effect of thrusting back any plug that may have been protruded. Above the dial is an electro-magnet, which attracts, on the passing of an electric current from the station which the train has just passed, one end of a lever, the other end of which protrudes the plug immediately underneath beyond the face of the dial, so that the attendant is enabled, by looking at the dial, to see whether the train has passed the station, and what time has elapsed since it passed.—*London Mech. Mag. No.* 1319, *Nov.* 18, 1848.

C. F. Johnson, Oswego, Tioga County, New York.—Improvement in Electric Telegraphs, May 16, 1848.—Claim.—First, forming signs for telegraphic purposes, by the dropping of balls upon an endless belt moving with an uniform velocity. Second, I claim the taking off impressions on paper, from balls as dropped substantially in the manner described.—*Franklin Institute Journal, Vol.* xvii, 3*d series, p.* 310.

John Lewis, Recardo, Lownds Square, Middlesex, England, Sept. 18, 1848.—1st, "Improvement" to a mode of insulating wire for electro-telegraph purposes; and 2d, to an apparatus for suspending them.—*Mechanics' Magazine, March*, 1849.

Edward R. Roe, Improvements in the Machine for Operating or Manipulating Morse's Electro-Magnetic Telegraph, May, 1849.—"The invention consists, 1st, of movable metallic types as conductors of electricity or galvanism; 2d, a metallic type bed upon which they are to rest, (which is also movable to and fro, somewhat in the manner of a common printing press;) and 3d, a movable board, which is also a conductor, and is made to traverse the face of the types, thereby making, continuing, or breaking the galvanic circuit, according to the form of the types.

Claim.—"What I claim as my invention is, 1st, The combination of

the body, the socket, the spiral ring, and the wand, with its conducting point and its non-conducting inclined planes, the whole constituting the traverser.

"2d, I claim the manner of giving the proper motion to the traverser, by the combination and action of the traverse wheel, the pully, and the cord which plays in it, the teeth upon the traverse wheel and the brakes operated by the type bed, in the manner set forth.

"3d, I claim the combination, for telegraphic purposes, of the types, arranged in the manner described, with the traverse and its wand, and its conducting point guarded by non-conducting inclined planes."—*Franklin Institute Journal, Vol.* xvii, 3*d series, p.* 320.

Charles Shepherd, London.—Improvements, April 16, 1849.—1st, The employment in chronometers, of apparatus actuated by electro-magnetism for winding up the remontoir escapement, which is retained by a detent.

2d, Giving audible signals in chronometers by means of a locking plate, and apparatus connected therewith, worked by electro-magnetism.

3d, An arrangement of apparatus for making and breaking the circuit.

4th, A peculiar arrangement and adaptation of apparatus, worked by electro-magnetism to chronometers.

5th, The combination in chronometers and telegraphs, of two pallets and detents for giving the step by step motion.—*Lond. Mech. Magazine, Oct.* 20, 1849.

L. G. Curtis, Ohio.—Improvement in Indicating Telegraph, January 16, 1849.—"The basis of the American Indicating Telegraph invented by me, is upon these principles, viz: Electro-Magnetism, machinery, figures and signs, and their combinations.

"This end is obtained by means of a revolving disk or dial plate, marked with successive series of numerals, 0 1 2 3 4, arranged in a circle or otherwise, said dial plate being revolved by degrees, as the galvanic current is completed and broken by the alternate vibration of the lever, to which the pallets, armature and springs are attached."—*Franklin Institute Journal, Vol.* xviii., 3*d series, p.* 280.

Caleb Winegar, New York.—Improvement in Magnetic Telegraphs, March 20, 1849.—Claim· "moving the paper on which telegraphic marks are made, into and out of contact with a stationary pen, by which means I avoid the danger of dispersing the ink, which happens when the pen is rapidly agitated.

"I also claim operating the magnet which effects the movement of the paper.

"I also claim the arrangement for conveying ink to the stationary pen," &c., &c.—*Franklin Institute Journal, Vol.* xviii., 3*d series, p.* 361.

M. Dugardin—Method of Insulating the Metallic Wires intended for Subterranean or Sub-marine Telegraph.—"This process consists of two operations. The first is the wrapping of ribbon of caoutchouc $\frac{4}{10}$ths of an inch wide, and $\frac{5}{100}$ of an inch thick, around a metallic wire, so that each turn of the wrapping shall cover about one-half of the preceding one. The second consists in wrapping spirally, and $\frac{4}{100}$ths thick, so that the edge of each turn shall touch the former, but without lapping over it. The leaden envelope *serves* to protect the caoutchouc from

blows, (Comptes de l'Academie des Sciences, for January 2d, 1849.)—*Franklin Institute Journal, Vol.* xvii., 3*d series, p.* 284.

Henry G. Hall, Ohio.—Improvement in Posts for Telegraphs, &c., Sep 19, 1848.—Preventing the posts from rolling, by combining the cast irc or artificial stone shoes with the posts.—*Franklin Institute Journal, Vo* xxiii., 3*d series, p.* 102.

To be Continued.

Translated for the Journal of the Franklin Institute.

Extract from a Report made by M. EBELMAN, *to the French Society fo the Encouragement of National Industry, on a new Combustible calle "Charbon de Paris," (Paris Coal,) by* M. POPELIN DUCARRE.

M. Popelin Ducarre has submitted to the Society the product which h has been manufacturing for five years, and which is now well known t the public under the name of "Charbon de Paris."

The agglutinating agent which M. Popelin Ducarre uses is the tar fro gas works, which is mixed with the fine debris of the combustible whic is to be utilized. The mixture is strongly compressed and moulded i cylinders. The agglumerated charcoal is exposed to a second carboniza tion. The tar, decomposing, leaves a residuum of hard and brilliar charcoal, which forms throughout the combustible mass a kind of net work, which holds together all the parts. The product thus obtained i but slightly friable, and may be carried to great distances without notabl loss.

It may easily be conceived that the process of which we have thus given a very brief description, may be applied to any carbonaceous debris, whether they come from wood, coal, turf, or other combustibles. The same combustibles (except coal) cannot be utilized in the raw state, in consequence of the contraction which they undergo during carbonization, which prevents the charcoal from having any solidity.

Manufacture of the Paris Coal.—M. Popelin Ducarre has established the following arrangements in his establishment on the *Boulevard de l'Hôpital.*

The gas tar is received in a large cistern which will contain 400,000 kilos, (882,200 lbs. av.) It is raised by pumps, and led into reservoirs near the apparatus in which the mixture is to be made. The small coals are first ground under conical mills, then mixed with the tar under cylinders; 15 kilos, (33 lbs. av.,) are employed for one hectolitre, (26 galls.) of the powder, which weighs about 30 kilos, (66 lbs.) The mixture then passes into the moulding apparatus, which compresses it powerfully, and forms it into cylinders of about 0·1 net. (3·94 in.,) log. and 0·03 lbs. (1·18 in.) diameter. These cylinders are arranged in rectangular cast-iron cases carried on cars, which are by means of a railroad, run into the furnaces where the carbonization is to take place. These furnaces are of a very ingenious construction; their arrangement is such that the combustion of the products furnished by the distillation of the tar develope the heat necessary for the carbonization. M. Popelin Ducarre propose *to place at the* end of these furnaces a steam boiler which shall utilise

the lost heat, and which will give him the 15 horse power necessary for the works of his establishment.

The Paris coal thus prepared ignites with considerable ease; it burns without flame or smoke, very slowly, and covering itself with a thick coat of ashes. A piece once well lighted continues to burn in the air, which distinguishes it strongly from coke; this slowness of combustion renders the Paris coal particularly useful for domestic purposes, especially for the working classes, and for small families, for certain uses in chemical laboratories, and for many uses in the arts for which a long continued and not too high heat is wanted. Its price is 15 to 16 francs per 100 kilos, ($30 to $40 per ton.) It contains a notable proportion of ashes, from 20 to 22 per cent. according to our analyses. The calorific value is, therefore, only about three-fourths of that of charcoal. This great proportion of cinders will probably injure its utility, in cases where a very high heat is required.

For the Journal of the Franklin Institute.

Launch of the Steamship State of Georgia.

On Thursday, 12th of February, the steamship *State of Georgia* was launched from the ship yard of Vaughn & Lynn. The following are her dimensions:

Length on deck, ...	205 feet.
Breadth of beam, ...	33 "
Depth of hold, ...	21 "

She is to be propelled by a single side lever engine, with a cylinder of 72 inches diameter, and 8 feet stroke, constructing by Merrick & Son, of the Southwark Foundry.

This ship is the first of a new line to be placed on the route from this City to Savannah, Georgia. Should the business warrant it, a second ship will be immediately put under contract. B.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, March 18, 1852.

James H. Cresson, President, P. T., in the chair.

John F. Frazer, Treasurer.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A Letter was read from the Royal Institution, London.

Donations were received from the Royal Astronomical Society, London; The Akron Branch of the Cleveland & Pittsburg Company, Akron, Ohio; The Mercantile Library Association of St. Louis, Missouri; The Alton & Sangamon Railroad, Alton, Illinois; T. H. Forsyth, Esq., Senate of Pennsylvania; and Messrs. Lindsay & Blakiston, Prof. John F. Frazer, A. B. Hutton, Samuel Sloan, Dr. T. S. Kirkbride, Frederick Fraley,

Trustees Philadelphia Gas Works; and the American Philosophica Society, Philadelphia.

The Periodicals received in exchange for the Journal of the Institut were laid on the table.

The Treasurer read his statement of the receipts and payments for th month of February.

The Board of Managers and Standing Committees reported their minute

The Board of Managers reported that they had organized, by electin Owen Evans, Esq., their Chairman, and appointing the second Wednes day evening of each month for holding their stated meeting.

The Standing Committees reported their organization, by electing thei Chairman, and appointing the time for holding their stated meeting, a follows:—

On Meteorology,	Owen Evans, Chairman,	1st Monday evenin
" The Library,	Dr. G. J. Ziegler, do	1st Tuesday do
" Exhibitions,	Prof. J. C. Cresson, do	1st Thursday do
" Cabinet of Models,	Chas. Welsh, do	do do
" Minerals and Geological Specimens,	J. C. Trautwine, do	2d Monday do
" Meetings,	Dr. B. H. Rand, do	do do
" Science and the Arts,	Prof. J. C. Cresson, do	2d Thursday do

On motion, the Committee on Exhibitions were instructed to take th necessary steps to hold an Exhibition of American Manufactures, nex Fall, agreeably to their recommendation this evening.

New candidates for membership in the Institute (3) were propose and the candidates (21) proposed at the last meeting were duly electe

Dr. Rand exhibited to the members a new form of cupping glass an artificial leech, the invention of Mr. Wm. L. Thomas, of New York. consists of a cylinder of glass, having at its upper end a loose strong ba of caoutchouc; by means of a plunger this is extended so as to occup the interior of the whole cylinder; upon the pressure being removed, partial vacuum is produced, as is formed in the ordinary cupping glas by fire or the air pump. By alteration in the form or size of the tube they may be employed on any part of the body. This apparatus is re markable for its cheapness and simplicity.

Dr. Rand also exhibited a portion of the copper boiler of the U. S Steamship Mississippi, showing the degree of corrosion it had undergone

Mr. G. W. Smith exhibited a drawing of the new Cathedral of St Peter and St. Paul, now in the process of construction in Logan Square.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on the Roofing of Dr. McDowell's Church.

The Committee on Science and the Arts constituted by the Franklin Institute of the Stat of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "The Cause of the Failure of the Roof of Dr. McDowell's Church," in Eleventh street, above Spring Garden, Philadelphia—REPORT:

That after a full examination of the fallen roof, and careful experiments with a model of the same, they have arrived at the conclusion that the

accident was owing partly to the employment of inferior timber, and partly to defective design.

The model of two trusses of the roof (of $\frac{1}{8}$th the full size) weighed *above* $5\frac{6}{10}$ lbs., and broke with a load of 516 pounds applied at its centre. The application of the weights was very gradual, occupying about a week; and the final load of 516 lbs. was borne for some hours before fracture took place. To this load at the centre, must be added one-half the weight of the model itself, (say 3 lbs.,) making in all 519 lbs. for the total breaking load, considered as applied at the centre.

Now, in applying the result of this experiment to the case before us, we have for our guidance, the fact sustained as well by theory as by experience, that in structures of this kind, (alike in every respect except size,) the strengths vary as the squares of their respective linear dimensions; while their weights vary as the cubes of the same dimensions.

Therefore, the strength of the actual roof, as deduced from that of the model, should have required for the breaking load of two of its trusses, *at the centre*, 64 times 519 pounds, or 33,216 pounds, and twice as much, or 66,432 pounds, if equally distributed over that portion of the roof supported by the two trusses.

Let us see by what weight equally distributed, the roof actually did break:—

The weight of the two actual trusses, as deduced from the model,—$5\frac{9}{10}$ lbs. (the weight of the model,) multiplied by 512, (the cube of 8,)	2867 lbs.
Weight of purlins deduced from those of the model,	1229
Tin roof, sheeting boards for ditto, lath and plaster, ceiling joists, &c.,	11,700
About 780 square feet of area, covered with saturated snow 7 inches deep, at 18 pounds per square foot,	14,040
Total,	29,836 lbs.

Or say 30,000 lbs.

From this we see that the roof broke down with a nearly equally distributed load not exceeding 30,000 pounds to each pair of trusses, instead of 66,432 lbs., as based upon the model experiment.

The Committee do not hesitate to ascribe this discrepancy chiefly to the difference between the timber of the model, and that of the roof itself; the latter having been found to contain many large knots and imperfections of grain, abundantly sufficient to lead to the want of correspondence.

The Committee therefore believe that had all the timber of the roof been as straight-grained and free from knots as that of the model, and the construction equally good in both cases, the roof might have stood for some years longer.

Independently however of the weakness produced by imperfections in the timber, the strength of the trusses was much below that required to ensure perfect safety.

To the securing of this end, a roof should always be so proportioned as to sustain at least three times its calculated breaking load; whereas in this instance we see that the actual breaking load was not quite one-half the calculated one. With a very heavy fall of snow the load would

have been much greater than at the time of the accident; whi dentially occurred while the building was empty.

By order of the Committee,

WILLIAM HAMILTON, *A*

Philadelphia, March 11, 1852.

BIBLIOGRAPHICAL NOTICES.

The Microscopist; Or, A Complete Manual on the Use of the Mi for Physicians, Students, and all lovers of Natural Science. illustrations. By JOSEPH WYTHES, M. D. pp. 191. Phil Lindsay & Blakiston.

This manual is a very useful work, and one which was ve wanted by the lovers of Natural Science, as all the works conta information in regard to the use of the Microscope and its r valuable applications are large and expensive; and it is somev prising that the best work in the English language has not printed in this country, namely, the work of Mr. John Quekett, strator of Minute Anatomy at the Royal College of Surgeons of]

The Manual of Dr. Wythes, therefore, fills a void in our nati rature, and is of so convenient a size as to be carried in the p used when manipulating with the Microscope. It is divided i teen chapters.

The first is devoted to an outline of the history and the impo Microscopic Investigations. The second, third and fourth to a tion of the Microscope, in its simple and compound form, with recent improvements, illustrated with numerous wood cuts, whic fail to make the instrument understood.

Chapters five to fourteen take up the subjects of procuring ing and mounting objects for the microscope, with a short noti uses of polarized light.

The subject of making preparations is then noticed, with recent improvements by Dr. Goadby, of England, and Dr. Go Philadelphia, which were noticed in a previous number of this and he concludes his volume by a series of miscellaneous hints t scopists, of great value.

Although the volume is a compilation, it is written with method, and contains just what the physician, the geologist, man of science wants, a practical and useful Manual of the Mic

---

Templeton's Engineer, Millwright and Mechanics' Pocket Co Revised, &c. By JULIUS W. ADAMS, Civil Engineer, and ju from the press of D. Appleton & Co., New York, is a useful r Tables and miscellaneous information adapted to the purpo mechanic, machinist, and engineer.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

MAY, 1852.

CIVIL ENGINEERING.

Extract from the Report to the Secretary of the Treasury, on Light-Houses of the United States.

Continued from page 238.

That the board respectfully recommend to the honorable Secretary of the Treasury, to direct that pending the future action of Congress on the subject of light-house improvements, the 7th section of the act making appropriations for light-houses, light-boats, buoys, &c., approved March 3d, 1851, in the following words:

SEC. 7. *And be it further enacted:* "That hereafter in all new light-houses, in all light-houses requiring new lighting apparatus, and in all light-houses as yet unsupplied with illuminating apparatus, the lens, or Fresnel system, shall be adopted, if in the opinion of the Secretary of the Treasury, the public interest will be subserved thereby," be strictly carried out, and that the necessary illuminating apparatus to fit up the light-houses now authorized to be built shall be of the lens system.

That a rigid and frequent inspection and superintendence by competent persons is essential to an efficient light-house establishment, and the board, therefore, recommend the appointment from the Army and Navy of a suitable number of inspectors for the lights and their accessories, throughout the United States.

That the present light-house establishment requires a thorough organization to ensure *to the service, efficiency* and economy, and therefore

the board recommend the organization of a light-house board, to be composed of Scientific Civilians, Army and Navy officers, to be charged, by law, with the entire management of the light-house establishment of the United States.

That all sea-coast and other 1st class lights should have not less than two keepers, including all 1st and 2d order lens lights.

That all constructions, renovations, and repairs of towers and buildings be hereafter made upon the plans, estimates, and drawings, and under the personal superintendence of an officer of engineers of the Army, in conformity to the 9th section of the act making appropriations for light-houses, light-boats, buoys, &c.; approved March 3, 1851.

That the lanterns, and all apparatus for illumination, ventilation, &c. &c., be constructed under the personal superintendence of an officer of engineers of the Army.

That the sea-coast lights be increased in power and range.

That all light vessels not yet fitted with illuminating apparatus requiring to be renovated, and all that may hereafter be authorized by law, be fitted with the best system of lamps and parabolic reflectors, both for fixed and revolving lights.

That more attention be given to the subject of models for light-vessels, constructing and mooring them so as to give greater assurance to the navigator, that they will be always found in position.

That light vessels be painted and fitted with distinguishing marks by day, to enable the mariner to know them without difficulty.

That there be a uniformity in painting, marking, and distinguishing beacons; and that no one be allowed to change the color or distinguishing marks of any beacon, sea mark, or light-house, without authority from the proper office at Washington, and after ample notice shall have been given through the medium of the commercial papers of greatest circulation, and by placards distributed at the different custom-houses, both at home and abroad, and among consuls and commercial agents of maritime nations.

That the buoys be made in size to subserve their proposed purpose, and that different shapes be employed for different channels, dangers, &c., &c.

That competent professional men be required to make frequent inspections of the lights and other aids to navigation along the entire coast.

That supplies of all kinds undergo a most rigid test and scrutiny by a professional person of high moral and social standing, before issuing them to light-keepers.

That light-keepers undergo an examination before being placed in charge of any light, and that they be instructed by a competent person upon the detail of all the duties confided to them.

That instructions, rules, and regulations, embracing every point of duty, be drawn up in clear, plain, and explicit terms, suited to the capacities of the persons for whose benefit they are prepared, and distributed to the light-keepers and others connected with the service; that the general rules and regulations be printed in large type, with conspicuous headings, and framed, so that the keepers may always have access to them; and those more in detail to be well bound, and the keepers required to transfer them to their successors should they leave the lights.

That frequent and rigid inspections of lights by districts be made by competent professional men, and that they make regular returns to the head of the light-house department.

That the keepers be required to keep meteorological and tidal registers, in addition to the necessary returns of the daily consumption of oil and other supplies.

That no light-house keeper be appointed who cannot read and write, and is not in other respects competent to the faithful discharge of the duties.

That a mode of supplying persons employed at lights on rocks or other isolated points, on board of light vessels, &c., &c., with rations, to enable them to devote their entire time and attention to the duties, should be adopted.

That light-keepers be required to devote their entire time and attention to their duties on pain of dismissal, and in no case should a keeper be allowed to follow any other vocation to the neglect of the light.

That no keeper be allowed to be absent from the light without a positive written permission from the district inspector.

That no one but a regularly appointed keeper, and his assistant or assistants, be permitted to attend to the apparatus, lighting, &c., &c., of a light-house or light vessel.

That the best cleaning powders, rags, &c., trimming scissors, and other necessary articles for keeping good lights, be furnished to the keepers; and that they be instructed that, under no pretext, should they employ any other means for keeping their apparatus in good order than those pointed out in the printed instructions from the Department.

That proper curtains be provided for the apparatus of each light-house, &c.

That light vessels never be removed from their stations for repair without first placing a substitute; and in the event of a light vessel parting her moorings, then that position be occupied without delay by a substitute.

That proper lists for the supply of each class of light-house, according to order or number of lamps, be made, and the person charged with the delivery of supplies be guided by it alone, without any discretionary power to increase, lessen, or change the quantity of articles to be on hand on a certain day.

That all articles of supplies be selected and tested by persons of professional ability and standing.

That the necessary steps be taken, without delay, to ascertain what additional aids to navigation are necessary in the bays of New York, Delaware, and Chesapeake, and their tributaries, to enable steamers and other vessels to enter them at night, and proceed direct to their destination.

That hereafter, buoys, required to be placed over newly discovered shoals, or over vessels wrecked in or near channels, or where they may endanger vessels, be placed without delay, and the expense be defrayed from the general appropriations for buoys.

That larger and better distinguished buoys be placed to mark the

channels of our principal bays and harbors, especially New York bar an bay, Delaware and Chesapeake bays, &c.

That appropriations be asked for two first-class light vessels, to be fitt up in the best manner with the most approved reflector or refractor app ratus, and with proper distinguishing characteristics; one for the Sou shoals off Natucket, and the other for Frying-pan shoals, off Cape Fea to be placed in the best positions for aiding navigators, under the dire tion of the Superintendent of the Coast Survey.

That appropriations be asked for renovating, and for first order le apparatus for the lights at Cape Hatteras, North Carolina; Cape Florid Florida; Dry Tortugas, Florida; Cape Canaveral, Florida; Cape Romai South Carolina; Fire Island inlet, New York; Cape Henlopen, Delawa Cape Henry, Virginia; Gay Head, Massachusetts; Montauk Point, Ne York; and for the following new lights, to be fitted with first order lens viz:

One, half way between Montauk Point and Fire Island light-hous Long Island; and one between Jupiter inlet and Gilbert's bar, Florida.

That the appropriation for Flynn's Knoll light-house be changed authorize range beacons for New York harbor.

That an appropriation be asked for a bell-beacon for Flynn's Knoll.

That, as the foregoing recommendations can only be thoroughly carri out under the orders of a properly organized bureau or board, and it is of vital importance to the interests of commerce and navigatio and of great importance in an economical point of view, that the prese light-house establishment should be improved as rapidly as possible.

To carry out these suggestions, it is further recommended:

That a light-house board be created, by authority of law, to be attac ed to the Treasury Department, with power to provide rules and regul tions for their meetings and proceedings, and for discharging, under t superintendence of the Secretary of the Treasury, all the duties appe taining to the management, maintenance, repair, renovation, illumin tion, inspection, superintendence, and construction of light-hous light vessels, beacons, buoys, and their appendages, in the United State

That the Secretary of the Treasury, as ex-officio president, with tw officers of the Navy of high rank; one officer of the Corps of Enginee of the Army; one officer of the Corps of Topographical Engineers of t Army, and two civilians, of high scientific attainments, whose servic may be at the disposal of the President, as members; and an officer the Navy, and an officer of Engineers of the Army, as secretaries, sha constitute the light-house board of the United States.

That the light-house board be authorized to appoint their chairman, t preside during the absence of the president, and perform such other duti as may be required by their rules and regulations.

That the light-house board be authorized to prepare such rules an regulations as shall be necessary for securing an efficient, uniform, an economical system of light-house administration, and for securing respon sibility in the inspectors, keepers, and others connected with the ligh house service, subject to the approval of the Secretary of the Treasur and which, when approved, shall be respected and obeyed, until alter or revoked by the same authority.

That the light-house board be required to meet four times a year, and subject to be convened by the Secretary of the Treasury, whenever, in his judgment, it may be necessary for the transaction of general or special business, a majority of whom shall constitute a quorum.

That such clerks as are now employed on light-house duties in the Treasury Department may be transferred to the light-house board without any increase of salaries; that the necessary accommodations for the clerks, secretaries, for the preservation of the archives, drawings, &c., &c., and for holding the meetings of the board, be provided in the Treasury Department.

That all archives, books, drawings, models, &c., &c., belonging to the light-house establishment, may be transferred to the light-house board, for their use, in the discharge of their duties.

That the President be authorized and required to appoint from the Army or Navy an inspector of lights, beacons, buoys, &c., for each light-house district, to be arranged by the board, with the approval of the Secretary of the Treasury; which inspectors shall be under the orders of the light-house board.

That the light-house board be authorized to prepare and distribute among the light-house keepers, inspectors, and others connected with the light-house establishment, such rules, regulations, and instructions, as may be necessary to secure an efficient, uniform, and economical system of administering the light-house establishment of the United States, and to secure responsibility from them.

That the light-house board be authorized and required to cause to be prepared by the engineer secretary of the Board, or by such officer of engineers of the Army, as may be detailed for that service, all plans, drawings, specifications, and estimates of cost, of all illuminating, and other apparatus, and of construction and repair of towers and buildings, &c., &c., connected with the light-house establishment; no bids or contract being accepted or entered into, except upon the decision of the Board, at a regular or special meeting, and through their properly authorized officer.

That, hereafter, all materials for the construction and repair of light-houses, light-vessels, beacons, buoys, &c., &c., shall be procured by public contracts, under such regulations as the Board may from time to time adopt, subject to the approval of the Secretary of the Treasury, and all works of construction, renovation, and repair, shall be made by the orders of the Board, under the immediate superintendence of their Engineer secretary, or of such Engineer of the Army as may be detailed for that service.

That it shall be the duty of the Light-house Board to furnish, upon the requisition of the Secretary of the Treasury, all the estimates of expense which the several branches of the light-house service may require, and such other information as may be required, to be laid before Congress at the commencement of each session.

That all acts and parts of acts, inconsistent with these recommendations, be repealed; and all acts and parts of acts relating to the light-house establishment of the United States, not inconsistent with these recommendations, and necessary to enable the light-house board, under the super-

intendence of the Secretary of the Treasury, to perform all duties relatin[g] to the management, construction, illumination, inspection, and superin[n]tendence of light-houses, light-vessels, beacons, buoys, sea-marks, an[d] their accessories, including the procuring and testing of apparatus, sup[p]plies, and materials of all kinds for illuminating, building, and rebuildin[g] when necessary, maintaining, and keeping in good repair the light-house[s] light-vessels, buoys, beacons, and sea-marks of the United States; an[d] the second and third sections of the act making appropriations for light[-]houses, light-vessels, beacons, buoys, &c., approved March 3, 1851, b[e] declared to be in full force, and have the same effect as though the light[-]house Board had not been created.

That no additional salary be allowed to any civil, military, or nav[al] officer who shall be employed on the light-house board, or who may b[e] in any manner attached to the light-house service of the United State[s] and that it shall be unlawful for any member of the light-house boar[d] inspector, light-keeper, or other person in any manner connected with th[e] light-house service, to be engaged, either directly or indirectly, in an[y] contract for labor, materials, or supplies for the light-house service, or t[o] possess, either as principal or agent, any pecuniary interest in any patent, plan, or mode of construction or illumination, or in any article of supply for the light-house service.

With such a board for the care and management of our present large and daily increasing light-house establishment, composed of the best adapted materials, from civil, military, and naval life, our lights must not only rapidly improve in efficiency, but also in economy.

By the assistance of the officers, proposed as inspectors, and the two secretaries of the Board, a general and systematic plan of classification, distinction, illumination, construction, repair, inspection, and superintendence, will, in a short time, be introduced, to the great advantage of commerce and navigation, and to the economy of the service.

The engineer secretary, with the assistance of officers of engineers now authorized by law to superintend the construction and renovation of light[-]houses, &c., will be able to prepare plans, estimates, and specification[s] of proposed works of construction and repair, and give a general superintendence to the lights, beacons, and buoys along the entire coast. Th[e] board will be able, at the close of the first fiscal year after it is in operation, to make detailed returns of expense of apparatus, combustibles, &c. &c., exhibiting at one view the actual annual expense of every light o[n] the entire coast; examine into the best modes of construction for specia[l] positions, make necessary experiments upon apparatus, oils, gases, &c. &c., for light house purposes; and determine, from information derive[d] from their own and other competent officers, what increased aids ar[e] necessary along the coast to recommend to Congress.

They would in a short time be able to furnish to navigators clear an[d] full descriptive lists of the lights, beacons, buoys, sea-marks, &c., wit[h] such notices of them as may be necessary to guide them in making ou[r] coast in tempestuous weather, and which could be reprinted at short intervals of time, if necessary, to point out new structures or changes.

The Coast Survey Charts would then be furnished with an account o[f] *every change* of position or character of lights, buoys, beacons, &c.,

&c., which would enhance their present great value to the navigating community.

Under an efficient organization, such as the proposed, the duty would be performed better and more economically than at present, and there would be great saving in the end, by affording to Congress estimates for proposed new works, rejecting works not considered necessary, and by introducing a class of structures which would require much less annual expense for repair than those now existing.

The ablest engineers of the Army would be called upon to decide upon plans for structures in cases involving doubts; the best and most durable illuminating apparatus would either be imported or fabricated in this country under the immediate eye of the officers of the Board, and when ready, be placed properly in the lanterns by the engineer charged with the work.

Boards for the execution of important duties are not novelties even in this country. Some, and indeed nearly all, of the most important undertakings which this Government has ever embarked in, have been planned and executed under the general supervision and management of boards.

They are found in nearly every branch of our civil and military institutions; of every name, and for almost every purpose. They have been successfully tried for this special purpose in France, where the Savans of the Academy of Sciences, without fee or reward, sit side by side with the Minister of State, the officer of the Navy, and the Engineer; in England, the Duke of Wellington presides, while the Prince, the Peer, the Admiral, the Commoner, and the retired Sea Captain, sit together and devise means for alleviating the hardships and lessening the dangers of the mariner in approaching their dangerous coast.

In Scotland this important branch of service is under the management of a board composed of the Sheriffs of the counties, lawyers, and other civilians, who meet four times a year, without any remuneration, to transact business connected with the lights of Scotland.

In addition to these meetings, there are numerous standing committees; some of which meet as often as onee a fortnight for the transaction of business, which is reported to the general meetings for their sanction and approval. There is attached to this board a seeretary and an engineer, who is the executive officer, upon whom devolves all the scientific details of construction, repairs, and illumination.

In Ireland there is also a board charged with the management of light-houses, &c., with a secretary, engineer, &c.

This board, as in Scotland, is composed chiefly of philanthropic Civilians and an English Admiral. The fact of Scotland and Ireland having no army or navy, and no distinct commercial marine, will readily account for such an organization, in which no motive, other than the praiseworthy one of doing good, could prompt individuals of standing, wealth, and distinction, to perform the drudgery of so laborious an office without pecuniary remuneration.

There is not a harbor in England, of any note, that has not its "Trinity Board," or "Board of Trustees," charged with the lights, beacons, and buoys; such, for example, as Liverpool, Newcastle-upon-Tyne, Hull, &c., &c., under all of which the lights are managed in a manner worthy

of the highest commendation, both for efficiency and economy. (V letter of Wm. Lord, Esq., Surveyor of the Port of Liverpool, and retu of local corporations, appendix.)

It is thus seen that the best managed lights of Europe are under management and direction of boards, with proper officers to assist th in their duties. That this service should be deemed sufficiently honora in France, Scotland, &c., to be performed gratuitously, is not so mu to be wondered at, when we recollect the high standard of excellenc has reached through the instrumentality of the philanthropic individu constituting those light-house boards.

In concluding this part of their report, the board consider it their d to urge upon Congress the necessity for a change in the present mana ment of our light-house establishment.

In investigating the subjects confided to them, they have endeavo to reach the truth from observation and research. That they have done injustice to any one, they feel perfectly conscious; to have passed o palpable defects in the present management of our lights, involving gr loss of human life and property, without pointing them out, would ha been culpable and unpardonable; and that they have looked as lenien as possible on many points considered exceptionable, it is believed w be clearly shown by their report.

The board have not sought so much to discover defects and point th out, as to show the necessity for a better system. Commerce and na gation, in which every citizen of this nation is interested, either direc or indirectly, claim it; the weather-beaten sailor asks it, and human demands it.

On the Alluvial Formations and the Local Changes of the South-Easte Coast of England. First Section, from the River Thames to Beac Head. By J. B. Redman.*

The paper stated, that the passage of shingle along the English coa due, as was generally believed, to the action of waves alone, took on t south coast a course from west to east, and on the east a course from no to south; during certain winds the shingle was heaped up coincident w their direction, and repeated withdrawals and renewals (the latter bei the most frequent) caused a leeward movement of the material, formi it, at the same time, into a series of triangles, of which the shore was t base. If any natural or artificial projection interrupted this motion, accumulation, which would increase and be held in check according the state of the wind, took place up to a certain point, or until the ang formed was filled up, when the shingle would pass round. With groyn by far the most common action was, unless they were of great height, short length, for the shingle, after accumulating on the weather side the level of the top of the groyne, to pass over it, and then travel to le ward.

The degradation of the north shore of Kent, the local formation shingle around the Isle of Thanet, by the wasting away of that chalk

* From the London Athenæum, December, 1851.

promontory, and the retention of large masses of alluvial matter in Pegwell Bay, were dwelt on. The main belt of shingle lying to the south of Deal, and extending from thence to Dover, with its early and present effects on the harbor at the latter place, were then described; also, the early condition of Folkstone Harbor, the large accumulation of shingle arrested to the westward of that haven, by the projection of a low-water pier, or groyne, at right angles to the harbor, and its effect upon the shore to the eastward, by retarding the progressive motion of the shingle in that direction. Further on, the curious formation at Dungeness Point, which it was reasonable to suppose did not at one time exist, as the parallel "fulls" of beach between Romney and Lydd, and extending from Winchelsea on the west to Hythe on the east, seemed formerly to have constituted the sea coast. The rectangular "full," running from the banks on the west side of Lydd towards the point, might have been created by an accumulation of shingle traveling from the westward, held in check by the outfall of the river Rother; the angle contained by this spit and the coast to the westward becoming gradually filled up with shingle, a silty deposit would take place on the east side, consequent on the gradual loss of Romney Harbor, and the length of the spit would be increased by the parallel ridges of shingle periodically added to, and traveling round it. Numerous examples, extending over two centuries, showed that the average annual increase was six yards, reaching, over certain periods, an average of eight yards per annum, the absolute increase since the time of Elizabeth being nearly one mile; and they proved conclusively, that the average progress seaward, producing a determinate aggregate elongation in a south-easterly direction, was much greater than had been generally assumed, though not regular, for the Ness had even been stationary during certain periods.

The gradual decadence of the ancient ports of Hythe, Romney, and Lydd, to leeward of this Point, was then alluded to; as also, the diversion of the outfall of the river Rother to Rye, once an estuary of the sea, and then forming Romney Harbor; the great increase of shingle to the westward; the early and abortive attempts to form a harbor at Hastings; the vast abrasion of the coast along Pevensey Bay, the harbor of which place had been lost by the elongation and extension of Langley Point. Between the origin of this Point and that of Dungeness, there was a remarkable similarity, both having originally had a tidal haven to the leeward, eventually choked up by the elongation of these spits across their outfalls; both had pools, or meres, arising from the land-locked waters, and in both cases the modern "fulls" of shingle could be plainly distinguished from the more ancient, by their forms and direction. The remarkable decrease of this point, about three-eighths of a mile, during the last century, appeared to arise principally from Old Brighton Beach no longer affording the necessary supply of shingle.

The early condition and present state of Cuckmere and Newhaven Harbors, the great degradation of the coast at Rottingdean, the sweeping away during Elizabeth's reign of the beach and town of Old Brighton, then standing on the site of the present Chain-pier, the materials from which formed the spits to the eastward, were described.—*Proc. Inst. Civ. Eng., December*, 1851.

AMERICAN PATENTS.

List of American Patents which issued from March 2d to March 30th, 1852, (*inc sive,*) *with Exemplifications by* Charles M. Keller, *late Chief Examiner Patents in the U. S. Patent Office.*

1. For an *Improvement in Life Preservers;* Stephen Albro, Buffalo, New York, March

Claim.—"I claim as my invention the sectional berth-bottoms, as represented by 1 2 and 3, and as minutely described,"

2. For an *Improved Arrangement of Steam Boilers;* William Barnhill, Pittsburg, Pen sylvania, March 2.

Claim.—"I am aware that it is not new to locate a cylindrical water vessel in the 1 of a boiler; and also, that such vessel sometimes contained flues; but these flues were this instance direct flues, and the fire box was placed outside of the boiler proper.

"What I claim, therefore, as my invention is, the arrangement of the cylindrical boi having return flues therein, within the flue of the main boiler, in such manner that t front end of said cylindrical vessel extends over the fire grates, and so that nearly its wh outer surface is exposed to the action of the flames, gases, &c., which, after their pass through the annular flue, proceeds to the chimney, through the small flues in such cyli drical vessel."

3. For an *Improvement in Grain Dryers;* Henry G. Bulkley, Kalamazoo, Michig March 2.

"The nature of my invention consists in constructing a cheap apparatus, to make much steam only as is necessary to keep the materials to be kiln-dried from scorchi and in using the escape heat to keep up the temperature of the steam thus made for ki drying rapidly."

Claim.—"What I claim as my invention is, so arranging an open steam or pan connexion with the fire chamber and steam chamber, and flues for the escape of heat, t the steam shall rise freely into the steam chamber, and the heat kept up by contact w the escape flues, as herein described, for the purpose of producing a high degree of h yet not so high as to injure the grain or other materials to be dried by its agency."

4. For *Improvements in Omnibus Registers;* F. O. Deschamps, Philadelphia, Penn vania, March 2.

Claim.—"What I claim as my invention is, the use of the ratchet wheel, E, and pawl, or their equivalents, for the purpose, substantially as herein set forth, of prevent the possibility of giving a blow to the hammer, by means of a recoil of the wheel, B.

"I also claim the combination, substantially as herein described, of the toothed wh G, to which the dial plate, A[2], is affixed, with the notched cylinder, I, and click, whereby the dial plate, A[1], for registering the concealed dial plate, A[2], 24, or any num of fares marked on the dial plates, A and A[1], substantially as herein set forth."

5. For an *Improvement in Chairs;* George O. Donnell, New London, New Y March 2.

"The nature of my invention consists in a metallic ferrule, ball, and foot piece, co bined and applied to the back posts of a chair, in such a manner as to let the chair t its natural motion of rocking backwards and forwards, while the metallic foot piece r unmoved, flat, and square, on the floor or carpet."

Claim.—"What I claim as my invention is, the construction and application of a tallic combination to the lock posts of chairs, so as to let the chairs take their natu motion of rocking backwards and forwards, while the metallic feet rest unmoved, flat square, on the floor or carpet, or any other metallic affixion substantially the same, which will produce the intended motion."

6. For an *Improvement in Cast Iron Car Wheels;* Orson Moulton, Blackstone, Massachusetts, March 2.

"This invention consists in connecting the hub and rim by two curved plates, having raised or projecting ribs running in cyma form on their inner sides, from the hub to the rim, and across the inside of the rim, the ribs on each side being placed opposite the middle of the space between those on the opposite side."

Claim.—"What I claim as my invention is, connecting the hub and rim of railroad wheels by curved parts, A A, having raised or projecting ribs, *a a*, and *b b*, of cyma form, on their inner sides, extending also across the inside of the rim, the said rims on each plate being placed opposite the middle of the spaces between those on the opposite plate, and each rib terminating in the opposite plate to that on which it stands."

---

7. For *Improvements in Knitting Looms;* William Henson, Newark, New Jersey, March 2.

Claim.—"Having now described the construction and operation of my improved knitting loom, I disclaim the invention of warp machines; also, the invention of needles, guides, sinkers, presser and actuating cams, or cut wheels, for racking the guide bar, the same having been used prior to my invention.

"But what I do claim is, 1st, the relative motions of the needles, hooks, and presser, as combined, to form the looped or knitted fabric, in combination with the stops or guards on the hook bar, to prevent the presser from coming in contact with the hooks; the whole being constructed and arranged substantially as herein set forth.

"2d, I claim the combination of mechanism for regulating the take-up motion according to the quantity of fabric formed, without varying the tension of the fabric, substantially as described."

---

8. For an *Improvement in Cotton Presses;* Lewis Lewis, Vicskburg, Mississippi, March 2.

Claim.—"What I claim as my invention is, the arrangement herein described, of a vertical revolving press, with toggle joint, operated by the toothed racks and fixed pinions, substantially as herein set forth."

---

9. For *Improvements in the Plates of Trunk Locks;* Conrad Liebrich, Philadelphia, Pennsylvania, March 2.

Claim.—"Having thus described the nature of my invention and the manner in which it is constructed, what I claim as new is, the guard constructed and applied as described, by which the lock is prevented from being wrenched or torn off from the article to which it is attached, and by which the hasp is prevented from being pryed or twisted, so as to be freed from the bolt; thus obviating the necessity of the ordinary back plate, substantially as set forth."

---

10. For an *Improvement in Blasting Rocks under Water;* Benjamin Maillefert, City of New York, March 2.

Claim.—"What I claim as my invention or discovery is, the blasting of rocks under water, by placing the explosive charge or charges on or against the surface of the rock to be blasted, and using the surrounding water as the means of resistance to the explosion, substantially as herein specified."

---

11. For *Improvements in Cast Iron Car Wheels;* Hiram W. Moore, Bridgeport, Connecticut, March 2.

"The nature and object of my invention and improvement consists in constructing cast iron car wheels for railroad cars, in such a manner and form as to prevent their fracture and cracking, by the unequal contraction of the metal composing them, while consolidating at the time of their manufacture; the unequal shrinking of the different parts being the greatest difficulty to overcome in casting perfect wheels."

Claim.—"What I claim as my improvement in railroad car wheels is, the concave rings formed and located as described, in *combination* with the spokes or braces in the

exterior ring, and the concavo-convex plate or partition, arranged and combined tially as herein set forth."

12. For an *Improvement in Machines for Printing Floor Cloths;* Simeon Lowell, Massachusetts, March 2.

Claim.—"What I claim as my invention is, the arrangement of the printing ma the stamping down mechanism, and the mechanism for advancing the piece cloth or of material to be printed and pressed, or stamped; such arrangement bei hibited in the drawings and as above described.

"And I also claim the combination of the lip bar or plate, *y*, the series of be *a' a'*, &c., the slide bar, R' or S, and the bar, *c'*, as made and operated substa manner and for the purpose of seizing the selvedge edge of the cloth, and mo piece as described.

"And I also claim the combination of mechanism for operating the coloring ca imparting to it its back and forth movements and necessary intervals of rest; the bination consisting of the rotating shaft, O, with its circular disks, Q R, and the tions, *i k*, the four hook bars, *l l p p*, together with the vibrating bars, *n o*, a together and operated substantially as specified."

13. For an *Improvement in Endless Chain Horse Powers;* Theodore Sharp, New York, March 2.

"The nature of my invention consists in constructing the endless chain of cur with teeth on the outer edge, which give motion to pinions at or over the one said curved links, on their inner edge, fitting on and corresponding with the perip drums or pullies, at either end, so that the carrying rollers are allowed to move while traveling the ends where a change of motion occurs, and much friction sarily avoided."

Claim.—"Having thus described my invention, I do not claim constructing th chains of horse powers, with curved or bent links, the under surface of which co to the surface of the revolving drums which support them, as that has been do but what I do claim as my invention is, the combination of the bent links *a a*, th ing drums B, and the pinions D, constructed and operating in the manner an purpose substantially as described."

14. For an *Improvement in Bridging Navigable Streams;* Benjamin F. Le New York, March 2.

"The nature of my invention consists in a new combination of bridge, cana and road, by means of which, neither the passage of carriages, or cars, across ri the passage of vessels up and down them, is impeded for an instant, draw bridge invention being rendered unnecessary."

Claim.—"What I claim as my invention is, the combination of canal A, t bridge and road, constructed and arranged substantially as above described."

15. For an *Improvement in Friction Clutches;* Gerard Sickels, Brooklyn, Ne March 2.

Claim.—"What I claim as new is, 1st, the arrangement of the levers C, and a for operating the segments E, E, substantially as shown and described, by which ment the segments are made to bind in the V collar F, or be relieved from it, as the segments, when bound in the collar, remaining in that state, the points or p having passed the line of pressure, unless acted upon by some extraneous fore moving of the vibrating slide G.

"2d, I claim, in combination with the arrangement of levers and arms, the V and segments E E, said segments being adjusted by screw rods *h*, and nuts *i*, as s

16. For an *Improved Encircling Suspender for Garments;* Harris H. Tinker, I *don*, Connecticut, March 2.

Claim.—"What I claim as my invention is, the combination of the spring a

with the straps, *h h*, and the circular pads, *k*, fig. 7, for the purpose of sustaining garments upon the human body, arranged substantially as set forth in the above specification."

---

17. For an *Improvement in Brick Machines;* Samuel L. Speissegger, Savannah, Georgia, March 2.

Claim.—"What I claim as my invention is, the employment of the plate, L, of the traveling mould table, operating simultaneously on the rods, *d d*, and pistons, *c c*, in the moulds, *b b*, in combination with the pressing plate, N, of a steam or other press, for the formation and delivery of brick, as substantially set forth."

---

18. For an *Improvement in Camphine Lamps;* Isaac Van Bunschoten, City of New York, March 2.

Claim.—"I am aware that a lamp has been made with a flanch or short pipe inside the wick tube, to enter inside the air tube, to prevent the resinous matter formed in burning, sticking the wick and air tube together; but I am not aware of packing ever having been employed at this point. Therefore, what I claim is, 1st, the application of a suitable elastic packing between the wick tube, and air tube, attached in any convenient manner, in camphine lamps, for the purposes and as described and shown.

"2d, I claim the application of a suitable ring or chamber around the wick tube, to receive or conduct water or other fluid to the wick, so that the light is extinguished in case of accident, as described and shown."

---

19. For an *Improvement in Compasses for Determining Variation from Local Causes;* John R. St. John, City of New York, Assignor to the St. John's Compass and Log Company, March 2; patented in England, December 27, 1851.

Claim.—"I do not claim the invention of a new mariner's or surveyor's compass, because these improvements can, in most instances, be added to compasses already in use; but I do claim as new and of my own discovery, or invention and improvements, the application of satellite or auxiliary needles to the magnetic compass, such needles being prepared, applied, and adjusted in the manner and for the purposes as herein set forth, including any merely mechanical variations that shall be actual equivalents of the means employed, as described and shown herein, and substantially the same as applied by me for the purposes herein set forth."

---

20. For *Improvements in Flour Bolts;* Samuel Cook, Adams' Basin, New York, March 9.

"The nature of my invention consists in so arranging a bolting machine, as that it shall perform all the functions of cooling, bolting, and bran-dusting, in one continuous operation, and thus avoid the necessity of three distinct and separate machines, and merely occupy the space usually allotted to the most compact bolting machines."

Claim.—"Having thus fully described my invention, what I claim therein as new is, in combination with a series of graduated stationary bolting disks in separate chambers, the rotating brushes placed above said disks, and the sweeps in a chamber below them, for the purpose of separating the bran, first and second middlings, and the flour, and conveying the meal, &c., through the machine, and for avoiding the use of a bran duster; the whole being arranged in the manner and for the purpose herein fully set forth."

---

21. For an *Improvement in the Water Gauge of Boilers, &c.;* Benjamin Crawford, Allegheny City, Pennsylvania, March 9.

Claim.—"What I claim as my invention is, the arrangement of the glass index tube, below the point at which the float chamber is connected with the water in the boiler, the water tube connecting with the boiler, at some distance from the bottom of the latter, so that it is not liable to become obstructed, which renders the indications of the float certain, while the coolness and quietness of the water in the index tube leaves it transparent, so that the index can be seen clearly and conspicuously."

22. For an *Improvement in Corn Shellers;* William Linsley, Township of Wadda Illinois, March 9.

"The object of my invention is to shell ears of corn of varying size and shape; and consists of stationary sectional spring shelling plates, with a rotating sectional spri shelling disk; the two acting in such manner that they yield to thick ears of corn, or the thick part of an ear, and thus shell off the grain, without breaking up the cob, wh they close upon small ears, or upon the small end of a thick ear, and insure the separati of the grain from the cob, whatever may be its size and proportions."

Claim.—"What I claim as my invention is, the combination of stationary sectior spring shelling plates, with a rotating sectional spring shelling disk, substantially in t manner herein set forth, the plates and disks having a wabbling or universal motic caused by the constant varying of the space between them, to accommodate itself at t same time to ears of varying size and shape, by which means the cobs are less broken a more thoroughly stripped than in machines as heretofore constructed, for shelling corn f into them promiscuously and in mass."

---

23. For *Improvements in Canal Lock Gates;* Charles Neer, Troy, New York, March 9

Claim.—"Having thus fully described the nature of my invention, what I claim there as new is, 1st, The opening of the lower gates of a canal or river lock outwards or dow stre m, in combination with the means described, or their equivalents, for operating the for the double purpose of saving length in the lock chamber with the same walls, and f allowing the gates to be opened before the chamber is entirely empty, so that the escapi water may carry out with it the boat, raft, or other thing, being passed through with th least possible delay.

"2d, I claim the stationary gate at the head of the lock which forms, with the breas wall of the lock, with the top of which it is level, a recess or chamber, through which the lock chamber may be filled at any desired height above the bottom of the lock, and thus save length of lock wall.

"3d, I claim, in combination with the stationary gate, the sinking head gate, extending across the lock, and reaching down a little below the top of the stationary gate, when the gate is shut, and which sinks or slides into the recess formed in part by said stationary gate, and is on a level therewith, when open, for passing boats, &c., for the purpose o saving in the length of the lock chamber, an amount nearly equal to the width of the gate

"4th, I claim the so placing of an adjustable bottom or water strip on the bottom of t lock, as that it may be operated upon by the pressure of the water within the lock chamber and be forced up against the gate, when prevented from being closed tight by an interve ning substance, substantially in the manner herein set forth and described."

---

24. For an *Improvement in Seed Planters;* Ira Reynolds, Republic, Ohio, March 9.

"The nature of my invention consists in a peculiar form of grain cylinder and box, fo conducting the grain into the teeth of the machine; also, the arrangement of a multiplying wheel or hub upon each end of the axle tree, for regulating the quantity of grain desire to be sown; also, the general arrangement of the several parts, to effect these ends."

Claim.—"I am aware, however, that driving wheels have been attached to the ends o the axle tree, for the purpose of driving grain cylinders, and do not wish or intend t claim as new the arrangement of driving wheels, abstractly considered, on each or eithe end of the axle tree, as mere driving wheels. But what I do claim as my invention is, the peculiarly formed curved lips or feeders, and longitudinal grooves or channels, so con structed and tightly fitted to the cast box, L, as to prevent any grain from passing into the chamber, except what is forced through the grooves by the lips or feeders, substantially as set forth."

---

25. For an *Improvement in Hay Rakes;* Jay S. Sturges, Litchfield, Ohio, March 9.

Claim.—"I disclaim suspending the head, so that each tooth acts separately, and the platform, L. What I claim as my improvement is, 1st, The arms projecting from the axle in combination with the joint, F, for the purpose of adjusting the position of the teeth to the surface of rough or smooth land.

"2d, Hanging the arms to the axle by means of the standard, I, and connecting rod, and also raising and lowering the arms as the teeth may require, by means of the pin and holes in the connecting rod and arms at J."

26. For an *Improvement in Melodeons;* A. L. Swan, Cherry Valley, New York, March 9.

Claim.—"What I now claim as my invention is, 1st, constructing the air receiving box of a melodeon, or other keyed wind instrument of a similar nature, which is operated by an exhausting bellows or pump, with a vibrating or movable top, connected to it by wings or joints, which fold or bend, substantially in the manner described, towards the external air which acts upon them, whereby the external air, acting upon the said wings, counteracts the inequality of the force exerted by the spring placed inside, to open or expand and enlarge the interior capacity of the box.

"2d, The manner of hanging the treadle, L, for operating the bellows, upon the two vibrating rods, M and M, attached to the floor, or to any object under the instrument, substantially as herein set forth."

---

27. For an *Improvement in Iron Fences;* John B. Wickersham, City of New York, March 9.

"The nature of my invention consists in so forming the mortises and loops upon the posts and rails of iron or other metallic fences, and the putting of the same together, as that they shall form a solid, firm fence, without the use of keys, bolts, wedges, or any other fastenings than those afforded by the shapes of said mortises and loops, and using for this purpose but single posts in each panel thereof."

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, so constructing the loops and mortises in the rails and posts of iron fences, as that when in place neither of them can be removed, using for this purpose single posts and rails, and neither bolts, wedges, keys, or any other fastening, except what is afforded by the peculiar shape of the said loops and mortises; and this I claim, whether the same be constructed as herein described, or by any other means essentially the same."

---

28. For an *Improvement in Ploughs;* Joshua Woodward, Haverhill, New Hampshire, March 9.

Claim.—"Having thus fully described my weeding plough, what I claim therein as new is, the plate constructed, arranged, and combined with the plough, substantially in the manner and for the purpose set forth."

---

29. For an *Improvement in the Manufacture of Door Knobs;* Benjamin Nott, Bethlehem, Assignor to John P. Pepper, Albany, New York, March 9.

Claim.—"I claim, substantially as set forth in the above specification, in the manufacture of vitreous metal knobs and similar articles, 1st, The application and use of a metal plug, to be entered into the socket and fitting it, the plug passing up from or through the bottom of the mould, for the purpose of preventing the melted material from filling the socket during the pressing operations, and at the same time facilitating the centreing and adjustment of the socket.

"2d, I claim the invention of, and substitution in the place of pincers and polishing rods heretofore known, a polishing rod capable of polishing several knobs simultaneously and by one operation, substantially as above described."

---

30. For *Improvements in Double Plane Irons;* Fordyce Beals, Pittsfield, Massachusetts, March 16.

Claim.—"I disclaim all contrivances, arrangements, or forms of cap or iron, which together compose a double iron, now in general use. What I claim as my invention is, the new and improved mode of fastening and adjusting the cap to the iron, by means of a projection and slot, forming a dove-tail slide, giving new facilities for the operation, and also a level surface to the back of the iron; also, the elongation of part of the width of the cap, and its occupying the place of a removed part of iron, giving the operator new facilities in nicely adjusting cap to edge of iron, without removing it from the stock, the same as herein described, using for the purpose the aforesaid arrangements of parts, or any other substantially the same, and which will produce the same effect in like manner."

and ingraining, or connecting together, the plys or different layers of cloth, woven either with plain (or uncolored) or colored yarns; nor do I claim the p producing figures by printing them in colors; nor do I claim to weave a carpe uncolored pile or warp in the Brussels process of weaving, and afterwards pri figures thereon in colors: but what I do claim as my invention, or new or improv facture, is, an ingrained, plyed printed carpet, made by a combination of the weaving in two or more plys, and ingraining the same, and subsequently pri figure or figures on both sides of the same, as described; the discovery having b by me, that the plying process prevents the colors printed on one ply from peneti other ply, so as practically to injure its other surface, to an extent which rende for the reception of colors and use as a carpet, as herein before stated, a great ment in trade being the result of such."

---

33. For an *Improvement in the Construction of Grate Bars;* Frederick P. Philadelphia, Pennsylvania, March 16.

"The nature of my invention consists in constructing grate bars for furnace soapstone, or other refractory substance, enclosed in a metallic casing, or susta metallic frame, when such is required."

Claim.—"I am aware that grate bars have been, heretofore, so constructed that the loose ashes of the furnace might accumulate in cavities therein, and p bar; but these have been found inefficient in practice, as any loose substance n cumulating in the cavity of a metallic grate bar, will shake off even with the ed of, and thus expose the bar to the action of the fire. I do not, therefore, wi understood to claim any particular form of grate bar, the above described frame b of easy construction and adaptation to the purpose; but any other suitable for given to this frame, which the nature of the refractory substance may render p What I claim as my invention is, the construction of grate bars for furnaces soapstone, or other refractory substance, for the purpose and in the manner herein a

---

34. For an *Improvement in Sofa Bedsteads;* John T. Hammitt, Philadelphia, vania, March 16.

"My improvements are comprised in the combination of certain convenienc

"I claim the method of making the joint at the end of the tube, which is effected by the friction of the packing around the tube, which forces the end of the tube against the bottom of the bore, and produces a joint, when the stuffing box is forced to its place, as herein mentioned and set forth."

---

36. For an *Improvement in Shovel Ploughs;* James Lattimer, Chatteogaville, Georgia, March 16.

Claim.—"Having thus fully described my invention, what I claim therein as new is, the combination of the wing, or half shovel plough, and the adjustable scraper, arranged on different stocks in the said beam, when the said scraper is arranged on the land side and rearward of the plough, and so that the grass, weeds, &c., shoved off by the scraper, will be thrown into the furrow made by the plough, the whole being arranged in the manner and specially for the purpose herein set forth and fully shown."

---

37. For an *Improvement in Cotton Gins;* Thomas J. Laws, Washington, Arkansas, March 16.

"The nature of my invention consists in the combination of an additional brush wheel, with the saws, and the stripping brush, of the ordinarily constructed cotton gin, in such a manner as to cause the said additional brush wheel to remove the motes from the cotton, while it is upon the teeth of the saws, by acting against the front sides of the said saw teeth, just before the cotton is stripped therefrom."

Claim.—"I do not claim the use of a mote brush, in combination with gin saws and the ordinary stripping brush, as I am aware that a cylindrical mote brush, revolving in the same direction with mine, has been used before; but what I do claim as new is, making the mote brush, (revolving in the direction described,) with wings, so as to act by a current of air, as well as by contact with the cotton on the teeth of the saws, substantially as herein set forth, in combination with the saws and grate."

---

38. For an *Improvement in the Treatment of Hydro-Sulphurets, and in Manufacturing Carbonates and Sulphur Compounds;* Charles Lennig, Philadelphia, Pennsylvania, March 16.

Claim.—"What I claim as my invention is, the manufacture of carbonate of barytes and strontiæ, by processes as above described, and in combination therewith, employing the sulphuretted hydrogen gas, evolved in the aforesaid process, for the producing of sulphur, or sulphuric acid."

---

39. For an *Improvement in Burners for Argand Lamps;* Austin Olcott, Rochester, New York, March 16.

Claim.—"What I claim as my invention in the within described lamp is, arranging the grooved tube for adjusting the wick inside of the wick and outside of the screw, that is, between the wick and the screw, and extending the pin from the wick holder, through the groove in the tube, into the score between the threads of the screw; thereby dispensing with the perforated tube heretofore used upon the outside of the wick, and leaving the wick open on the outside, so that the material to be burned may have free and unobstructed access around the wick."

---

40. For an *Improvement in Machines for Cutting Screws on Rails and Posts of Bedsteads;* J. Parsons Owen, Norwalk, Ohio, March 16.

Claim.—I do not claim, of themselves only, reversible cutter heads, as such, or equivalent arrangements, have long been used, such as reversible cylinders and similar devices; but what I do claim as my invention is, constructing the reversible cutter heads E and F, of arms placed at right angles to one another, and carrying reverse right and left hand cutters *i i*, and *k k*, in combination with the eccentric snug *g*, and flanch *f*, of the screw spindle C, for the purposes and advantages specified, all being constructed and operating as shown and described."

Claim.—"What I claim as my invention is, constructing, arranging, and o reciprocating plane, which cuts off the shaving by its forward stroke, and feeds by its backward stroke, and the clamps and gripes, or stops, with which such connected, as herein described, so that the board is fed at the back stroke of and planed at its forward stroke, a distance equal, or thereabouts, to the throw of the plane, whereby a greater length is planed, by a given number of strol plane, than in reciprocating planes that feed themselves by their own motion, fore constructed; and also, the injurious shocks and strains are avoided, whicl planes are caused by the necessity of making the cut considerably shorter stroke."

---

43. For an *Improvement in Cupping and Breast Glasses;* William S. Thor wich, New York, March 16.

"My invention consists in connecting the piston of an exhausting apparatus barrel thereof, by means of an elastic tube, which not only packs the piston, but as a spring to draw the piston towards that end of the barrel to which the elast made fast."

Claim.—"What I claim as my invention is, the improved exhausting appara described, for surgical and other purposes; said apparatus consisting of a combi a tubular spring piston with a barrel, substantially as herein set forth."

---

44. For an *Improvement in Pattern Cards for Jacquard Looms;* Samuel T. Lowell, and Edward Everett, Lawrence, Massachusetts, March 16.

"The object of our invention is to facilitate the operation of changing the figu tern of cloth that is woven upon a jacquard loom, and to reduce the expense now in changing and perforating the common pasteboard cards."

Claim.—"What we claim is, the combination of the buttons with the metalli described, the buttons being so riveted or attached to the card as to allow of th turned, for the purpose of closing or opening the holes to which they are re attached."

---

45. For an *Improvement in Hot Air Registers;* William Turton, Bushwick, N March 16.

Claim.—"What I claim is, the crown wheel or section of a crown wheel, in

47. For an *Improvement in Instruments for Inhaling Powders;* Ira Warren, Boston, Massachusetts, March 16.

"My instrument, or powder inhaler, is designed for the purpose of inhaling medicine into the throat and lungs, and at the same time to prevent any of the said medicine from lodging in the mouth."

Claim.—"Having thus described my powder inhaler, what I claim as my invention is, the instrument above described, for inhaling powder, &c., into the throat and lungs; the said instrument consisting of a receiver, with holes in its bulb or end, covered by and working loosely in an exterior tube, which prevents any of the medicine from lodging in the mouth, substantially as above described."

---

48. For an *Improvement in Hinges for Stove Doors, &c.;* Charles J. Woolson, Cleveland, Ohio, March 16.

Claim.—"What I claim as my invention is, the connecting and hanging of the door or doors upon the fronts of stoves or grates, so that they may be opened or closed, without marring the beauty or affecting the convenience of the same, in either case, or exposing to view the hinges or inside of the door, as described."

---

49. For an *Improved Arrangement of Jack Chain Machinery;* Hickford Marshall and Seth S. Cook, Assignors to John Bostwick, Jr., and Elbert White, Stamford, Connecticut, March 16.

Claim.—"What we claim as our invention is, the arrangement on the bed plate, A, of the nipping jaw, G, the mandrel, E, and pin, F, with the turning lever, K, furnished with pin, *f*, moving under the table, B, in the manner and for the purpose substantially as set forth and shown."

---

50. For an *Improvement in Omnibus Steps;* Josiah Ashenfelder, Philadelphia, Pennsylvania, March 23.

"The nature of my invention consists in an inclined covering or protector, immediately connected with the outside of the door, so secured thereto as to open and shut therewith, with a brush or broom secured to the bottom of the covering as to open and shut therewith, for the purpose of cleansing the step or steps, together with a back board, operating as a protection to the inside of the step, so as to prevent mud, &c., from being thrown upon the same."

Claim.—"What I claim as my invention is, the application of the inclined covering or protector to the outside of the omnibus door, as described, to prevent persons from standing, lying, or sitting on the steps, in combination with the brush or broom, secured to the bottom of the covering or protector, so as to open and shut therewith, for the purpose of cleansing the step or steps, each step, if more than one, requiring a brush or broom attached, together with a back board to protect the inside of the step, as described."

---

51. For an *Improvement in Shop Awnings;* William H. Bakewell, City of New York, March 23.

Claim.—"Having thus fully described my invention and improvement, I wish it to be known that I do not claim the pullies, cords, cog wheels, &c.; neither do I claim the enclosing of an awning, as that has already been done in many different ways, to my knowledge. What I do claim as my invention is, the method of protecting the awning, by the construction and arrangement of the cylindrical sheathing or covering, in combination with the slat, in the manner and for the purpose herein described and fully set forth."

---

52. For *Improvements in Machines for Stamping Ores;* William Ball, Chicopee, Massachusetts, March 23.

Claim.—"What I claim as my invention is, the combination of the washing basin or contrivance, L, with the stamp rod and its bearing, so as to operate in manner and for the purpose as specified.

"I also claim the deflective plate in the entrance spout or hopper, as combined with the same, and the *mortar and stamper,* and used for the purpose as specified.

"I also claim the improvement in the stamp head, or the making of it with a grea stamping surface on one side of its axis of rotation than it is on the other; the same bei for the purpose of preventing packing of the charge, as specified.

"I also claim the mode of applying the stamp head to the stamp rod, viz: by means the circular arcs or curves of the sides of the universal dovetail connexion with the wed key, as described."

---

53. For an *Improvement in Ploughs;* E. Ball, Greentown, Assignor to Isaac N. McAb Canton, Ohio, March 23.

Claim.—"What I claim as my invention is, connecting the beam to the plough irons means of a pivot and stay bolt, and adjustable standard; the whole being constructed an arranged as described, so that the front end of the beam can be set towards either side, either extremity raised or lowered, without changing the height of the other, or both e tremities raised simultaneously and equally, or unequally, substantially as set forth."

---

54. For an *Improvement in Friction Primers for Cannon;* William Ball, Chicopee Massachusetts, March 23.

Claim.—"I claim the combining with the discharging string and tube of the primer, a cylinder or plug of leather, or other like substance, inserted and secured in the upper end of the primer, and having the exploding string passing through it, as above set forth; the said plug or cylinder serving the purpose of a breech, to confine the charge when exploded, as a protector of the sand paper and priming, against the absorption of humidity, and as a bearing for the string to draw over when pulled."

---

55. For an *Improvement in Machinery for Felting Cloth;* George G. Bishop, Norwalk, Connecticut, March 23; ante-dated September 23, 1851.

Claim.—"What I claim as my invention is, the method herein described of hardening the bat by alternate steaming and jigging, substantially as herein set forth, whereby one section of the bat is jiggered, while an adjoining section is steamed, preparatory to being jiggered.

"I also claim the process of steaming and jiggering two or more bats simultaneously, whereby much time and labor are saved, and the texture of the cloth is improved.

"I also claim constructing a machine for jiggering felt bats, in such manner that it will subject successive portions of the bats to equal amounts of jiggering, and then stop, whereby a greater uniformity of texture is secured in the cloth.

"I also claim the arrangement of the steam pipes and adjutages in the steam chamber, substantially in the manner and for the purpose herein set forth."

---

56. For an *Improvement in Marine Signals;* Thomas H. Dodge, Nashua, New Hampshire, March 23.

Claim.—"What I claim as my invention is, the employment for signaling or indicating the course of a vessel, of two lights of different colors, attached to or hung in a cylinder or disk, which is capable of revolving on a fixed axis, so as to change the position of the lights; the position of either light, relatively to the other, being made to point the course in any manner, substantially as described."

---

57. For *Improvements in Planing Machines;* John Howarth, Salem, Massachusetts, March 23.

Claim.—"What I claim as my invention is, the reciprocating plane for scoring the face of the board transversely, and reducing it to an uniform thickness, arranged substantially as herein described, in a compound frame, which carries the plane back and forth across the board by a regular and positive motion, and back and forth lengthwise of the board by a motion dependent upon the reciprocal action of the board against the planes in one direction, and of springs against the frame in the opposite direction, substantially as herein set forth.

"I also claim the method of smoothing the surface of boards or other lumber, by plane irons reciprocating endwise, and operated in such manner that the tendency of one to

draw the board towards that side of the machine to which it is moving, is counteracted in whole or in part by the tendency of one or more of the others to draw the board towards the opposite side of the machine; these several counter tendencies being thus made to neutralize each other, substantially as described."

---

58. For an *Improvement in Swingle-Trees;* Charles Howard, Madison County, Illinois, March 23.

Claim.—"I do not claim the ring and link as my invention; but what I do claim is, the flanch, as above set forth, wrought or cast, in combination with the ring and link, for the purpose of forming attachments, substantially in the mode set forth above."

---

59. For *Improvements in Machines for Making Cordage;* William Joslin, Waterford, New York, March 23.

Claim.—"What I claim as my invention is, the application of the fan *j k*, in combination with the pullies *f h*, belt *g*, gears N, O, P, Q, and bobbin M, as a drag, or take-up, as above described."

---

60. For an *Improvement in Flour Packers;* Nathan Kinman, Lewistown, New York, March 23.

"The nature of my invention consists of a spiral cone plate, for the packing of flour, so as to give to the flour an equal density throughout the barrel, and also a friction roller clutch to work in connexion with the above mentioned spiral cone plate."

Claim.—"What I claim as my invention in the above described machine for packing flour, is the friction roller clutch, constructed and arranged in the manner and for the purpose substantially as set forth."

---

61. For *Improvements in Smut Machines;* Thomas H. M'Cray, Madisonville, Tennessee, March 23.

Claim.—"What I claim as my invention is, the formation of a series of corrugated recesses within the periphery of the cylindrical casing of my improved smut machine, substantially of the forms represented in the drawings, when the said cylindrical casing is combined with a rotating beater, which has its beating surfaces *a a*, &c., arranged in positions which incline obliquely to the radii of the beater, for the purpose of throwing the smut and kernels of grain into the said series of corrugated recesses, in such directions that they will, in entering and rebounding therefrom, be brought in contact with their entire surfaces, and thereby produce so great an amount of friction action as to break up the smut and white caps, and polish the kernels of grain, without breaking the same."

---

62. For an *Improvement in Cracker Machines;* John M'Collum, City of New York, March 23.

"The nature of my invention consists in attaching to the frame of the cracker machine, a set of springs, in such a manner as to let the bed plate rest upon them, and as the cutters are forced down to cut the dough, to yield or recede under the pressure, and thereby prevent the sudden cut of the knives on the apron, and at the same time keep them longer in contact with the apron, to take their "scraps," than would be the case if the bed plate was made permanently fast to the frame, and the knives suddenly impinged upon it, and then receded."

Claim.—"Having now described my invention and its operation, what I claim, therefore, is the use of the bed plate resting upon or supported by springs, or other equivalent devices, so that a yielding or receding action is obtained in the bed plate, while under the pressure of the cutters, or while the cutters are pressing down, for the purposes and in principle of construction and operation, substantially as set forth."

---

63. For an *Improvement in Manufacturing Artificial Teeth;* William S. McIlhenny, Philadelphia, Pennsylvania, March 23.

"The nature of my invention consists in the manufacture of a tooth, or teeth, into a condition ready for the furnace, by the simple process of moulding."

Claim.—"What I claim as my invention is, the formation of an artificial tooth or teeth, from spar, silex, clay, sand, glass, or any materials used for the above purpose, into a suitable condition for the finishing furnace, by the simple operation of moulding, thereby avoiding the tedious and uncertain process of enameling."

---

64. For an *Improvement in Machines for Paging Books;* Stephen E. Parrish, Assignor to Edwin B. Clayton & Sons, City of New York, March 23.

"The nature of my invention consists in combining together, a series of number or letter plates, upon a cylinder or barrel, and cutting on the peripheries of the plates, a series of numbers or letters, from one to the decimal point, and by means of springs and pins, attached thereto, and holes through the plates corresponding with the number of letters on their peripheries, and a changer plate, attached to the end of the cylinder, operated by a cap plate, having a ratchet and pawl contained therein, made to count or number from 1 to 99,999, as the circumstances require."

Claim.—"Having now described my invention and its operation, what I claim, therefore, is, 1st, the use of the type plates, having channel ways and springs in their faces, and holes in them, corresponding to the ten subdivisions of their peripheries, and their inner circumferences divided into ten equal sides, in combination with a barrel having stop pins in its circumference, for the type plates and a changing plate attached thereto, and ratchet wheel, cap plate, and pawl and bent lever, for the purpose of operating a series of number plates, the said combination of parts being entirely distinct from any known mode of producing the same result, (that is, counting,) which I lay no exclusive claim to, the principle being well known; and I therefore limit my claim to combination of parts, substantially as set forth.

"2d, I claim the use of the rod C, lever E, inking roller lever J, and arm I, in combination with the type wheel, substantially for the purposes as set forth.

"3d, I claim the use of the inking roller frame and rod attached thereto, and rotating ink plate, in combination with the lever J, slide O, and type wheel and levers operating the same, substantially for the purposes as set forth.

"4th, I claim the bed R, with guides attached thereto, in combination with the table and type wheel, substantially for the purposes as set forth."

---

65. For an *Improvement in Machines for Jointing Shingles;* William Stoddard, Lowell Massachusetts, March 23.

"My improvements consist, 1st, in the arrangement by which I am enabled to point the shingle, and plane or shave both sides at the same time, this effect being produced by planing knives, set in plane stocks, moving vertically, the operation of which will be hereinafter explained. I have also made an improvement by which the machine will cut or joint the edges of any width of shingle, the shingle itself serving to regulate the position of the jointing knives."

Claim.—"Having thus described my improvements in shingle machines, what I claim as my invention is, the arrangement of the horizontal sliding boxes, which carry the jointing knives, by which they will cut the edges of any width of shingle, the shingle itself operating the devices for holding the boxes firmly, and in the proper position, while the shingle is being cut as herein above set forth."

---

66. For an *Improvement in Air-Heating Stoves;* J. M. Thatcher, Lansingburgh, New York, March 23.

Claim.—"What I claim as my invention is, the combination of the inverted domes, or frustums F, I, M, and plate P, with the short tubes *b b*, *f f*, *i i*, *l l*, connecting them substantially in the manner herein described, for the purpose of effecting the connexion between the lower ends of the fire or draft flues, and carrying the air through them to the spaces between the cylinders or tubes."

---

67. For an *Improvement in Making Paraffine Oil;* James Young, Manchester, England, March 23; patented in England, October 7, 1850.

Claim.—"What I claim as my invention is, the obtaining of paraffine oil, or an oil containing paraffine, and paraffine from bituminous coals, by treating them in manner herein before described."

68. For an *Improvement in Sausage Stuffers;* Thomas W. Bailey, Lewistown, Pennsylvania, March 30.

Claim.—"Having thus fully described my improved sausage stuffer, what I claim therein is, the combination of the three cornered ovoid shaped cylinder, with the curved spring scraper, operating in the manner and for the purpose, substantially as herein fully set forth."

69. For an *Improvement in Mills for Grinding Ores;* William Ball, Chicopee, Massachusetts, March 30.

Claim.—"What I claim as my invention is, the combination and arrangement of the two grinding, or pulverizing wheels, one or two endless screws, and the troughs which such wheels and screw, or screws, revolve in, all made and applied so as to operate together, in such manner as to raise the ore up and crush it between the two wheels, and not only return, or move the heavier or too weighty particles towards or back to the wheels, but allow the lighter ones or sufficiently reduced particles to flow out of the machine, as described."

70. For an *Improvement in Excavating Machines;* Charles Bishop, Norwalk, Ohio, March 30.

"This invention consists in the employment of an inclined cutter wheel, so constructed that it serves also as a horse walk, by which means the power is applied directly to the wheel itself, without the intervention of other mechanism."

Claim.—"I do not claim inclining the cutter cylinder; neither do I claim placing the horses within or upon ditching machines, for the purpose of working them: but what I claim is, so constructing the inclined wheel or cutting cylinder E, that it is made also to serve the purpose of horse walk, by which means the power of the horse is applied directly to the cylinder itself, without the intervention of other mechanism, substantially as herein described."

71. For an *Improvement in Trusses;* Frederick M. Butler, City of New York, March 30.

Claim.—"What I claim as my invention is, the application of trusses and supporters of the guard spring pad, as above described."

72. For *Improvements in Machinery for Shaving the Heads of Screw Blanks, Rivets, etc.;* John Crum, Ramapo, New York, March 30.

Claim.—"What I claim as my invention is, the movable stop, which determines the position of the screw blanks between the jaws, and then returns to let said blanks fall through, substantially as specified, in combination with the vertical hollow spindle or mandrel, as specified.

"And finally, I claim the feeding tube, which conducts the screw blank, &c., to the hollow spindle, substantially as specified, in combination with the cam on the cutter head, or its equivalent, for moving the said tube out of the way of the cutter, as described."

73 For an *Improvement in Razor Strops;* John Demerit, Montpelier, Vermont, March 30.

"The nature of my invention consists in attaching the strop, at the ends, to the case containing it, in such a way that it will be suspended, and revolve, without the edges touching the case."

Claim.—"What I claim as my invention is, the mode of attaching the strop to the case, so that it will not be soiled by the faces of it coming in contact with the case, and so that it will revolve, as herein described, using for that purpose, the aforesaid case, strop, bearing spring, and pivots, in combination."

74. For an *Improvement in Dredging Machines;* James Hamilton, City of New York, March 30; patented in France, December 16, 1845.

Claim.—"I do not limit myself to the means described for raising and lowering the frame, nor to the shapes of the shovels or scoops, or the means of moving them, as other

mechanical means, shapes, or arrangements, may be used; neither do I limit myself in number of the shovels, or scoops, or the proportions of the parts.

"1st, I claim the shovels or scoops, forming the bottoms of compartments in a proj frame, and moving at one end on a hinge, or similar contrivance, the other end bei lowered, to cause the scoop, as the frame is moved along, to collect the sand, or mud, other material operated on, and retain the same by suitable mechanical means, operati to lift the scoop and close the bottom, as described and shown."

---

75. For an *Improvement in Rice Hullers;* Peter McKinlay, Charleston, South Carolin March 30.

"The nature of my invention consists in having a circular conical chamber, into whic the rice is put after having the outside shell taken off by a pair of stones, operated on i the usual way; the rice, after having the outer shell taken off, has still a thin film or ski on it, of a dark color.

"The object of my invention is, to take off this skin or film, by rotary friction, withou breaking the grain, by which means the market value of the article is increased."

Claim.—"I claim as my invention, the combination of the concave fluted chamber with the smooth curved radial beaters for hulling rice, as set forth."

---

76. For an *Improvement in Shovel Ploughs;* Washington F. Pagett, Stone Bridg Virginia, March 30.

Claim.—"What I claim as my invention is, the construction of the handles, and th principle or mode of shifting the same, as the same are herein fully described, with the operation; the invention of the common shovel plough is, of course, disclaimed."

---

77. For *Electric Whaling Apparatus;* Dr. Albert Sonnenburg and Philipp Rechte Bremen, Germany, Assignors to Christian A. Hainaken, United States, March 30.

"The nature of our invention consists in catching and securing sperm and rig whales, as well as other animals of the sea, by the application of electric galvan current, conveyed by a conductor to the instrument commonly called whale iron, or ha poon, and which is used to be thrown into the fish."

Claim.—"What we claim as our invention is, the application of electric galvan current, conveyed by a conductor to an instrument which is to be thrown into sperm an right whales, as well as other animals of the sea, in order to secure them."

---

78. For an *Improvement in Gang Ploughs;* Harvey Killam and George Valleau, Scott ville, New York, March 30.

Claim.—"Having thus described our improvements in the wheeled cultivating gan plough, we will state that we are aware that axles of wheels have been hung to the fram of the carriage, so as to vibrate, or be suffered to vibrate, and keep them at right angle to the motion of the ploughs, when moving in a direct line, and when the ploughs ar turning the axles, being made to assume a line in the direction of the radius of the circl formed by the track of each wheel. We are also aware that gangs of ploughs have bee placed diagonally, one behind the other, and the wheels of the carriage of the same als placed diagonally, one behind the other; therefore, we lay no claim to these parts. But what we do claim as our invention is, mounting the tongue or pole upon the timbers, and uniting the same by an intermediate jointed connecting rod, to the horizontal coupling rod, which unites the front and rearward ends of the pivoted arms of the axles, whereby the direction or guiding of the gang of ploughs is regulated by the action of the team itself, in moving in any direction the attendant may require.

"We also claim confining the tongue or pole between the horizontal plate and timber, by means of a fulcrum bolt, for the purpose of allowing the tongue or pole to vibrate, or move right or left, with the direction of the team; whereby the required direction is given to the propelling and supporting wheels, and whereby the tongue or pole may be shifted or adjusted in its position, to accommodate two or three horses, and yet maintain its central draft with the ploughs."

79. For an *Improvement in Bedstead Fastenings;* William Shaw, Clarion, Pennsylvania, March 30.

Claim.—"What I claim as my invention is, the combined actions, or the combination of the link and wedge as above described, for fastening bedsteads."

---

80. For an *Improvement in Rat Traps;* James Sheward, Somerset, Ohio, March 30.

Claim.—"I do not claim any arrangement by which a living animal may be forced into a cage and retained; nor any arrangement by which an animal may be killed and its body retained: but what I claim as my invention is, the manner of constructing a machine for the killing of animals and throwing their bodies from the trap, and self-setting the same, substantially as described and shown."

---

81. For an *Improvement in Apparatus for Boring Artesian Wells;* John Thomson, Philadelphia, Pennsylvania, March 30.

Claim.—"What I claim as new is, the spring or brace, as above described, or its equivalent, with the twisted flat bar, or other device, turning systematically the boring instrument, whilst using a rope instead of rods, while sinking a bore-hole in the earth, in search of water or minerals."

---

82. For an *Improvement in Smoothing Irons;* Nicholas Taliaferro, Augusta, Ky., and William D. Cummings, Murphysville, Kentucky, March 30.

"The object of our invention is, to render practicable the permanent heating of smoothing irons, chiefly by the proper regulation and distribution of the draft to a charcoal or other fire within the iron, by an arrangement which prevents also the spilling of the ashes and refuse of combustion."

Claim.—"Having thus fully, clearly, and exactly described the nature, construction, and operation of our improved smoothing iron, what we claim therein as new is, the application, substantially as described, to a self-heating smoothing iron, of a tube or chamber, at the bottom of the fire-box, provided with a registered mouth or inlet, some distance above the bottom, and at its lower portion with distributing apertures, communicating with the fire, whereby the draft is applied from beneath, and equally at every part, and placed under the control of the operator, without permitting the escape of ashes, or other refuse of combustion."

---

83. For an *Improvement in Candle Wicks;* Cornelius A. Wortendyke, Godwinville, New Jersey, March 30.

Claim.—"I claim a candle wick, manufactured by the method herein specifically described."

Re-issues for March, 1852.

1. For an *Improvement in Machines for Planing, Tonguing, and Grooving;* Joseph Powell, Nelson Barlow, and Edward Holden, St. Louis, Missouri, Assignors to Robert G. Eunson, City of New York; patented February 27, 1847; re-issued March 9, 1852.

"The nature of this invention relates, 1st, To a method of springing and holding or confining the board or plank to the bed plate, while the thicknessing or reducing wheel or planes are operated upon it; 2d, To certain improved means of forming the tongue; and, 3d, To certain means of forming the groove."

Claim.—"What I claim as the invention of the aforesaid Joseph Powell, Nelson Barlow, and Edward Holden, and what I desire to secure by the re-issue of the letters patent granted originally to them, is, 1st, The combination of the pairs of feeding rollers, G G, and G′ G′, with the bed plate, C, and the rotating reducing wheel, D, substantially in the manner and for the purpose herein set forth, viz: the placing the axles of the pair of feeding rollers, G G, preceding the reducing cutter wheel, and the axles of the pair of feeding rollers, G′ G′, immediately following the same, respectively, out of a vertical line with

each other, thereby bringing the upper roller of each pair nearer to the shaft reducing wheel than the lower one, for the purpose of springing the board or plank bed plate, as herein more particularly described.

"2d, In making the rebates by which the tongue is formed, I claim the employm a series of incising cutters, in combination with stationary planing tonguing cutte several cutters being so arranged as to act upon both sides of the angle of the simultaneously or alternately, and cut the shavings from both the said sides, so as t at one operation a tongue, both of whose sides and shoulders have been subjected action of cutting edges, substantially as herein set forth.

"3d, In forming the groove, I claim the employment of a series of incising cutt combination with stationary planing grooving cutters, substantially as described, for ing the tongue, being arranged so as to cut upon both sides and the bottom of the g as set forth."

---

2. For an *Improvement in Machinery for Dressing Staves;* Isaac Judson, New I Connecticut; patented May 1, 1847; re-issued March 9, 1852.

Claim.—"What I claim as my invention is, 1st, The arrangement of the whe ring of cutters, for the purpose and in the manner substantially as herein before descr

"2d, The holding of the stave firmly in position to be dressed, in the immediate vi of that portion which is being cut, while all the other portions are left at full libe assume whatever position its configuration may indicate for the purposes and in the ner substantially as herein before described.

"3d, The employment of the two independent spring rollers, or their equivalent, with equal force upon each of the edges of the stave, irrespective of their relative thic in combination with the guides and the cutters, as described."

---

3. For a *Powder Proof Lock;* William Hall, Boston, Massachusetts; patented Aug 1848; re-issued March 30, 1852.

Claim.—"What I claim as my invention is, the combination of the handle shan cam, one or more pins, and their sustaining holes or apertures, in their application belt, and one or more tumblers, and as operated substantially as specified, meani claim said combination as composed of the afore described elements and their acces to combine with or in combination with the bolt and tumblers; a contrivance for thr or moving the bolt back and forth; another, or a key, separate and distinct from such trivance, and for the purpose of moving the tumblers into correct positions for the b be moved, and which shall be perfectly stationary, after it has so moved the tumbler a movable plate, or its equivalent, applied to the contrivance, by which the bolt is act and made to entirely cover the key, and prevent access to it, when the bolt is put i tion; not meaning by the above to claim the separate combination of either of the mentioned three parts, with the bolt and tumblers, but intending to limit my claim combination of all of them therewith, so as to operate in conjunction with them, tially as specified."

---

48. For an *Improvement in the Gearing of a Seed Planter;* Marshall J. Hunt, F Sun, Maryland; patented June 3, 1851; re-issued March 30, 1852.

Claim.—"Having thus fully described my invention, what I claim therein as new combination with the slotted sliding seed bar, the stationary lugs on the plate, an concave on the cap; the whole being arranged and constructed as herein described.

"I also claim the combination and arrangement of the double bolt, with its slotted rock shaft, with its arms, and pitman, for the double purpose of giving motion to the ing apparatus, and also regulating the quantity of seed to be sown, when said pitm operated by a long crank, upon which it travels, as herein fully shown and represent

---

DESIGN FOR MARCH, 1852.

1. For a *Design for a Cooking Stove;* Samuel M. Carpenter, Erie, Pennsyl March 30.

Claim.—"Upon the general arrangement of said ornaments upon said stove, a original design, your petitioner asks a patent under the provisions of law in such made and provided."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Remarks on H. B. M. Screw Steam Frigate "Arrogant." By Chief Engineer, B. F. Isherwood, *U. S. Navy.*

The *Arrogant* has long been considered the most successful application of an auxiliary screw to a war steamship. Having been furnished directly from her Chief Engineer with a number of her indicator cards, and accompanying data of speed, revolutions of screw, &c., I thought it might be of interest to steam engineers and ship constructors, to publish these results, giving additionally the full dimensions of *hull*, *engine*, *boilers*, and *screw*, obtained from the Chief Engineer of the vessel and other sources, in order that a correct opinion might be formed. As these results may be relied on, they will go far to correct some very exaggerated reports of the performance of this vessel, as well as to show the latest manner of using steam in the British Navy.

Hull.

Length between perpendiculars,	200 feet.
Length of keel for tonnage,	172 " 9⅝ inches.
Breadth, extreme,	45 " 8½ "
Breadth, moulded,	44 " 4 "
Depth of lower hold,	15 " 1 "
Mean draft, half coal in, and all other weights full,	19 " 0 "
Burthen,	1872 tons.
Displacement at 19 feet draft,	2470 "
Immersed amidship section at 19 feet draft,	587 square feet.

Engines.—Two of Penn's horizontal trunk, condensing engines, placed on board at Woolwich in 1848. The exhaust pipe, which is the highest part of the engines, is 4 feet 8 inches below the water line; the tops of the cylinders are 6 feet 11 in. below water line.

Diameter of cylinder, 60 inches, " trunks, 24 "	equivalent to a diameter of 55 inches.
Stroke of piston,	3 feet.
Space displacement of both pistons per stroke,	98·99 cubic feet.
Diameter of main steam pipe,	18 inches.
Leading into steam pipe of diameter of	14 "
Diameter of eduction pipes,	18 "
Diameter of overflow pipes,	18 "
Extreme length of engine and boiler rooms, bulkhead to bulkhead,	56 feet.

Slide Valves.

Lead on top lid, or lid to cylinder cover,	3-16 inch.
Lead on bottom lid,	5-16 "
Carries steam on top stroke,	28 inches.
" bottom stroke,	26 "
Lead of exhaust on top lid of valve,	7½ "
" bottom lid of valve,	7½ "
Length of slide faces,	9 "
Length of ports,	5 7-16 "
Exhaust ports at bottom,	3⅝ "
" top,	3⅛ "

Note.—When steam is admitted into the top end of the cylinder, the exhaust port is open 3 15-16 inches; and when admitted into the bottom end, the exhaust port is open 3¾ inches. The lead at the crank end of the cylinder is 5-16 inch, and at the cylinder cover end 3-16 inch.

Shafting.

Diameter of shaft at main bearing,	10½ inches.
" connecting shaft bearing,	9½ "
" screw propeller shaft at large end,	14 "
" " " small end,	9 "

Length of shafting from inside of stern post to forward part of coupling on crank shaft, ...	69 feet 1 inch.

BOILERS.—Four horizontal tubular boilers, placed in such a manner that the top of th steam chest is 3 feet 4 inches below the water line.

Number of tubes in each boiler, ...	264.
Outside diameter of tubes, ...	$2\frac{1}{2}$ inches.
Length of tubes, ...	5 feet 6 inches.
Length of each boiler, ...	12 " 3 "
Breadth "	10 " 7 "
Height "	7 " 4 "
Number of furnaces in each boiler, ...	3.
Length of each furnace, that is, of grate bars in each furnace,	5 feet.
Breadth " " "	3 "
Area of total grate surface, ...	180 square feet.
" heating " in tubes, 3800·544 sq. ft.	
" " " furnaces, &c., 634·000 "	
Area of total heating surface in the 4 boilers, ————	4434.544 sq. feet.
Extreme height of chimney when up above grates, .	44 feet.
Length of upper or sliding part of chimney, . .	15 feet 8 inches.
Diameter of lower or fixed part of chimney, . .	.5 " $3\frac{3}{4}$ "
" upper or sliding part "	5 " $1\frac{1}{4}$ "
Weight of water in boilers, ...	39 tons.
Consumption of English bituminous coal per 24 hours, working with full power at sea with steam alone, in good weather, boiler pressure 5 pounds per square inch, cut off at $\frac{3}{4}$ths the stroke from commencement, making $44\frac{3}{4}$ double strokes of piston per minute, initial cylinder pressure 18 pounds per square inch, ...	32 tons.
Sea water evaporated under the above circumstances by one pound of coal, inclusive of loss by blowing off at 3-32, and by waste of steam in clearance and nozzles, . .	6·836 pounds.
Coal consumed per hour per square foot of grate surface, .	16·600 "

Weight of coal carried in bunkers, 260 tons, or sufficient for 8 days steaming at full power.

SCREW.—One true screw, placed at the stern in a sliding frame, so as to be raised out of water when the ship is under sail alone.

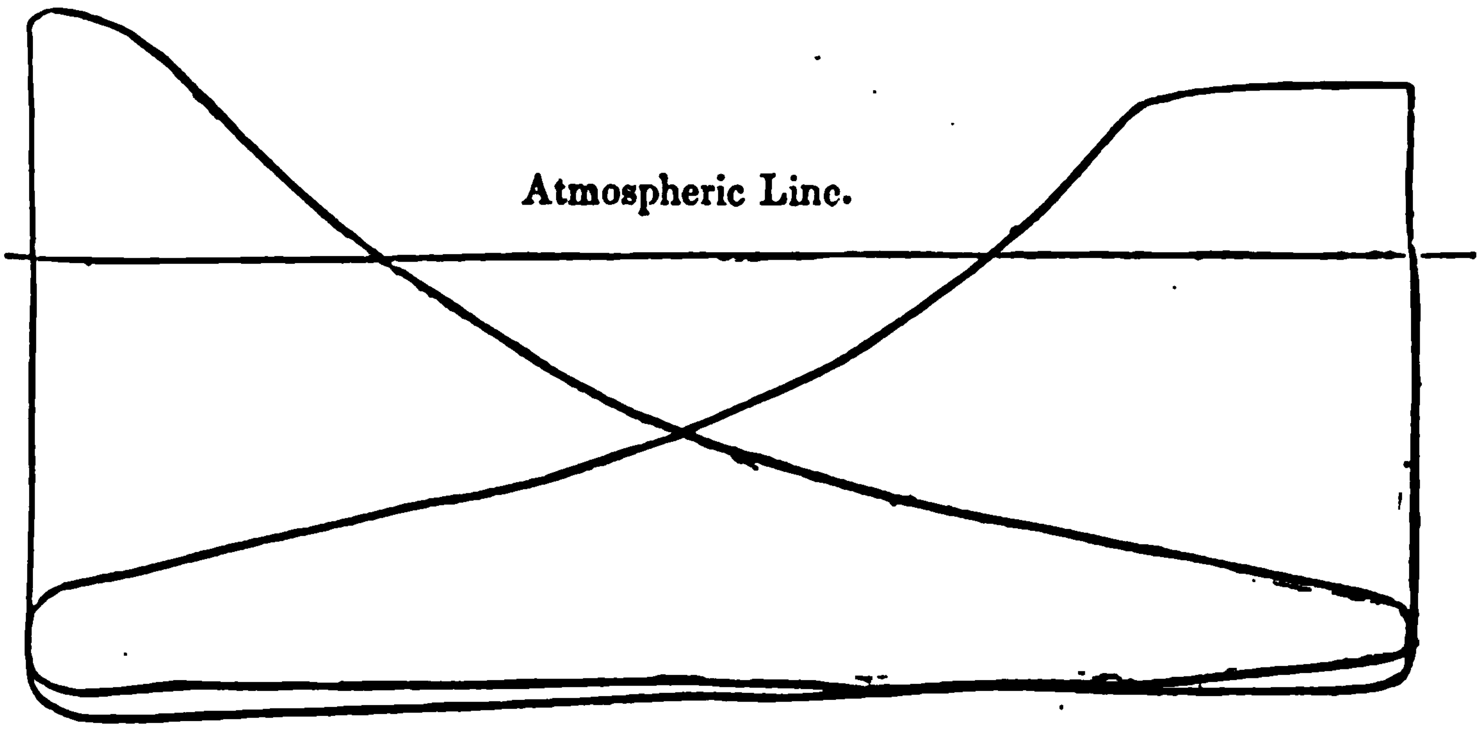
Diameter, ...	15 feet 6 inches.
Pitch, ...	15 " 0 "
Length on axis, ...	2 " 6 "
Number of blades, ...	2.
Helicoidal area of screw, ...	136 square feet.
Area of screw projected on a plane at right angles to axis,	61·85 "

RESULTS.

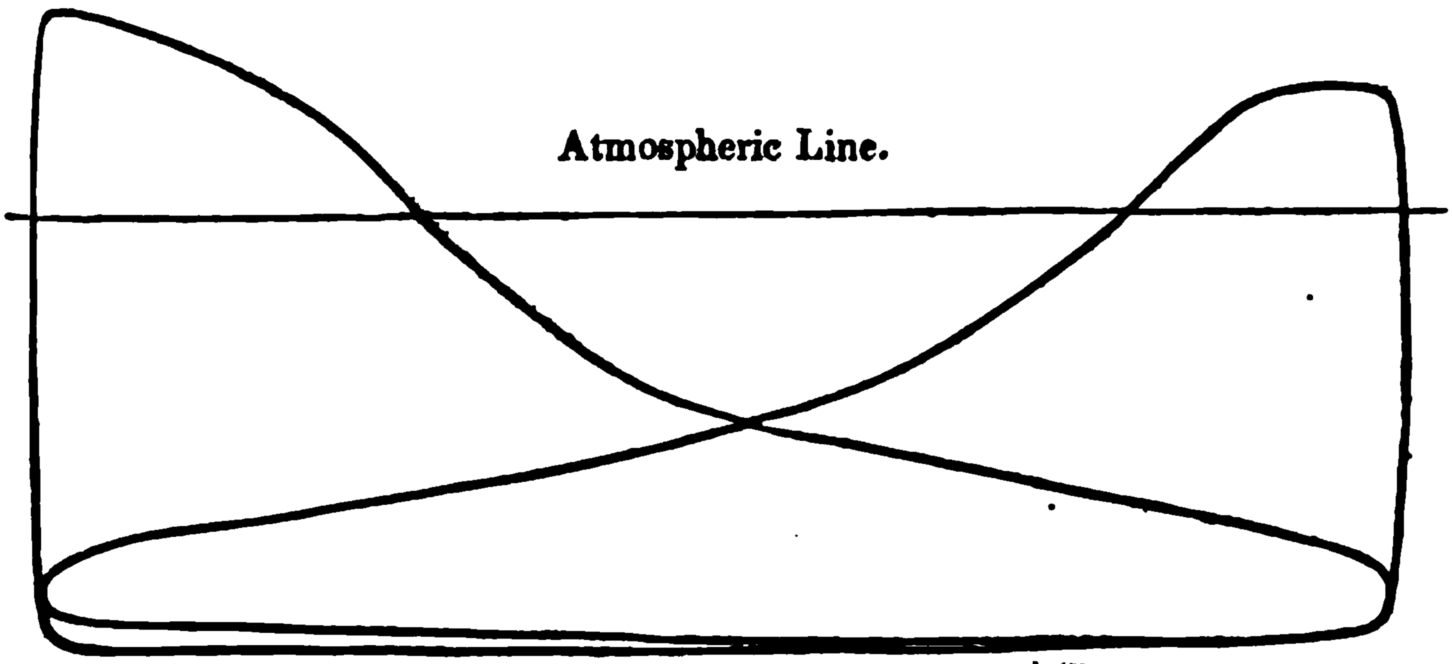
Speed of vessel at sea under steam alone, in good weather, working at the reduced power used in calms and smooth water, viz: cutting off at about $\frac{1}{8}$th from commencement of stroke, and having a mean effective pressure per square inch of pistons throughout the stroke of $7\frac{3}{4}$ pounds, making $33\frac{3}{4}$ double strokes of piston per minute, . 3·833	knots of $6082\frac{2}{3}$ feet.
Horses power developed by engines under the above circumstances, ...	223·99
Speed of vessel at sea under steam alone, in good weather, working with full power, viz: an initial pressure in cylinder of 18 pounds per square inch, cutting off at $\frac{3}{4}$ths the stroke from the commencement, giving a mean effective pressure throughout the stroke of $13\frac{1}{2}$ lbs. per square inch of pistons, making $44\frac{3}{4}$ double strokes of piston per minute, 5·08	knots of $6082\frac{2}{3}$ feet.
Horses power developed by engines under the above circumstances, ...	520·96
Slip of the screw under the above circumstances, .	23·04 per cent.

INDICATOR DIAGRAMS FROM STEAM CYLINDERS. SCALE, 10 POUNDS TO THE INCH.

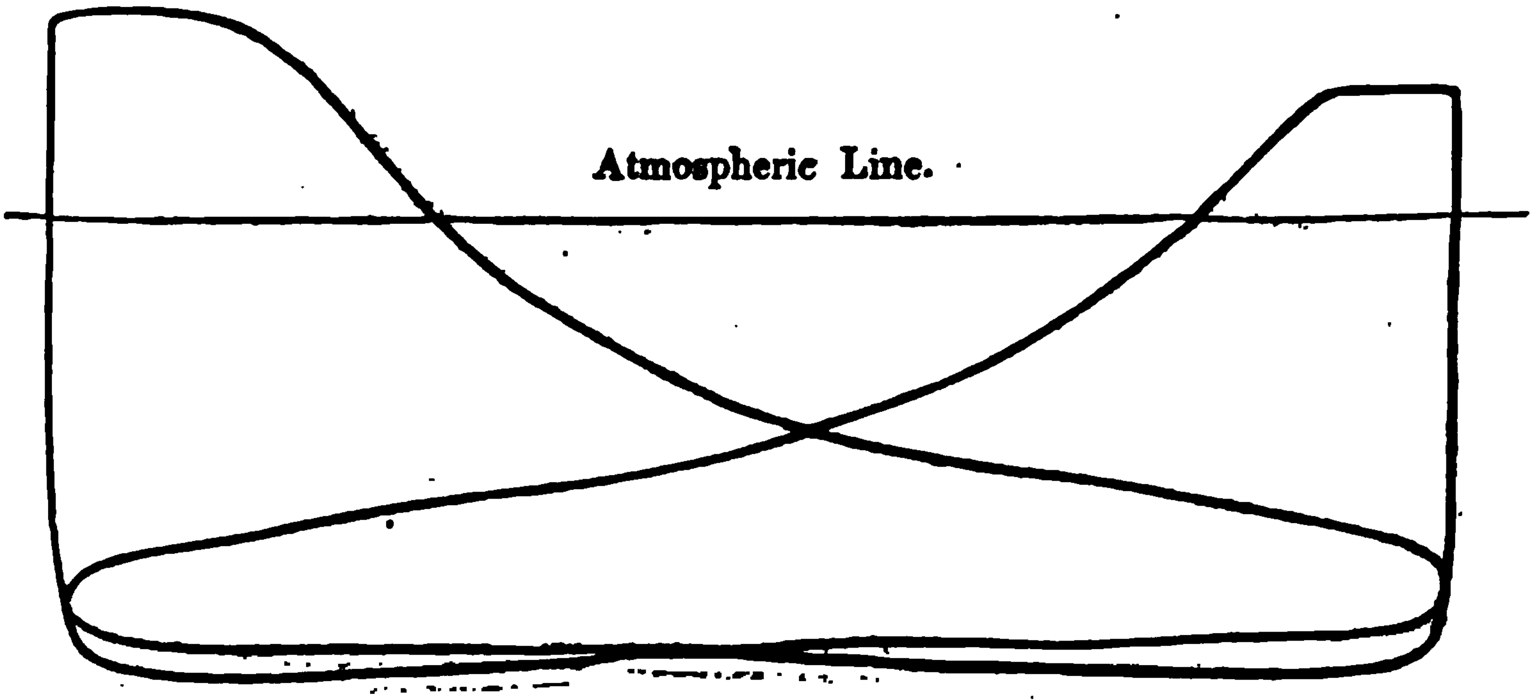
No. 1.—Taken August 4th, 1851. Sea smooth, and variable head airs; speed by paten log, 3·70 knots per hour; revolutions of the screw, 33 per minute; mean effective pressure per square inch of piston, 8·14 pounds. *Slip of the screw, 24·22 per cent.*



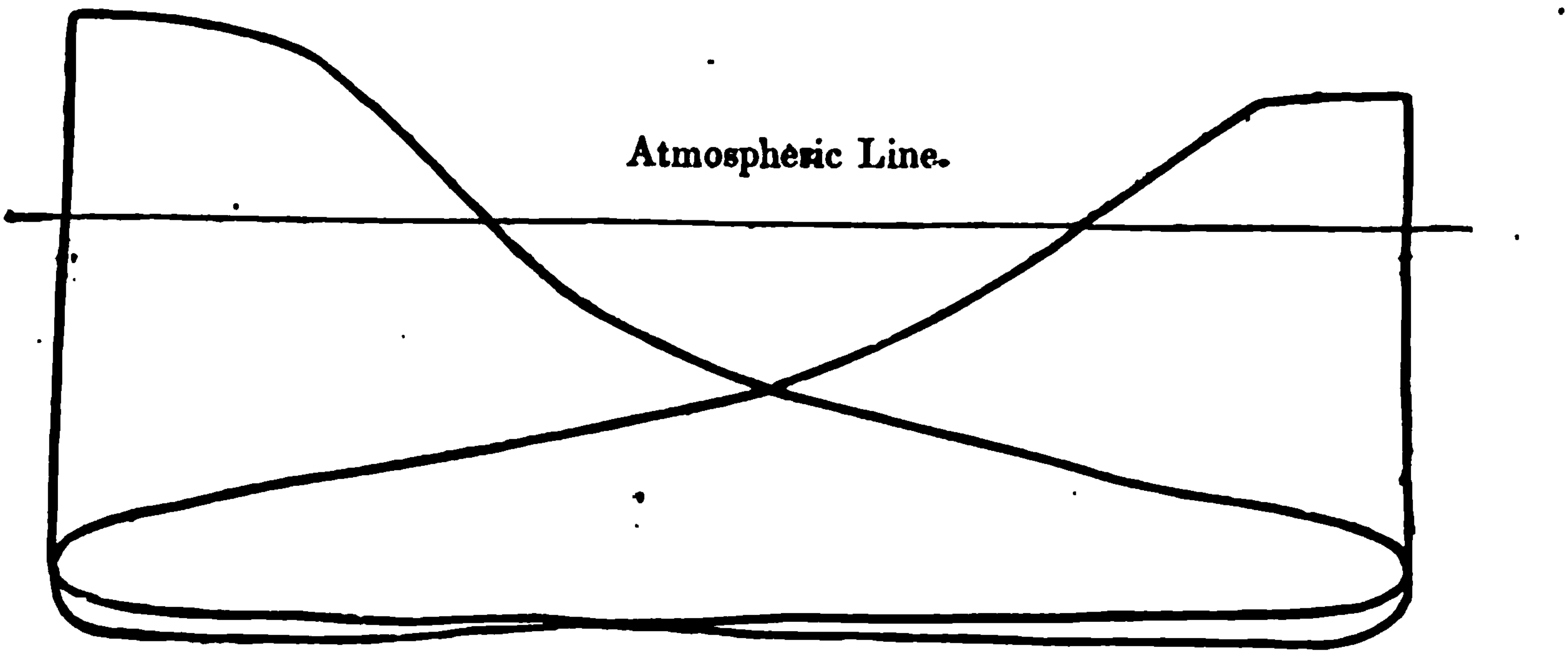
No. 2.—Taken August 5th, 1851. Moderate head swell, and airs ahead; speed by patent log, 4 knots per hour; revolutions of the screw, 34 per minute; mean effective pressure per square inch of piston, 7·48 pounds. *Slip of the screw, 20·49 per cent.*



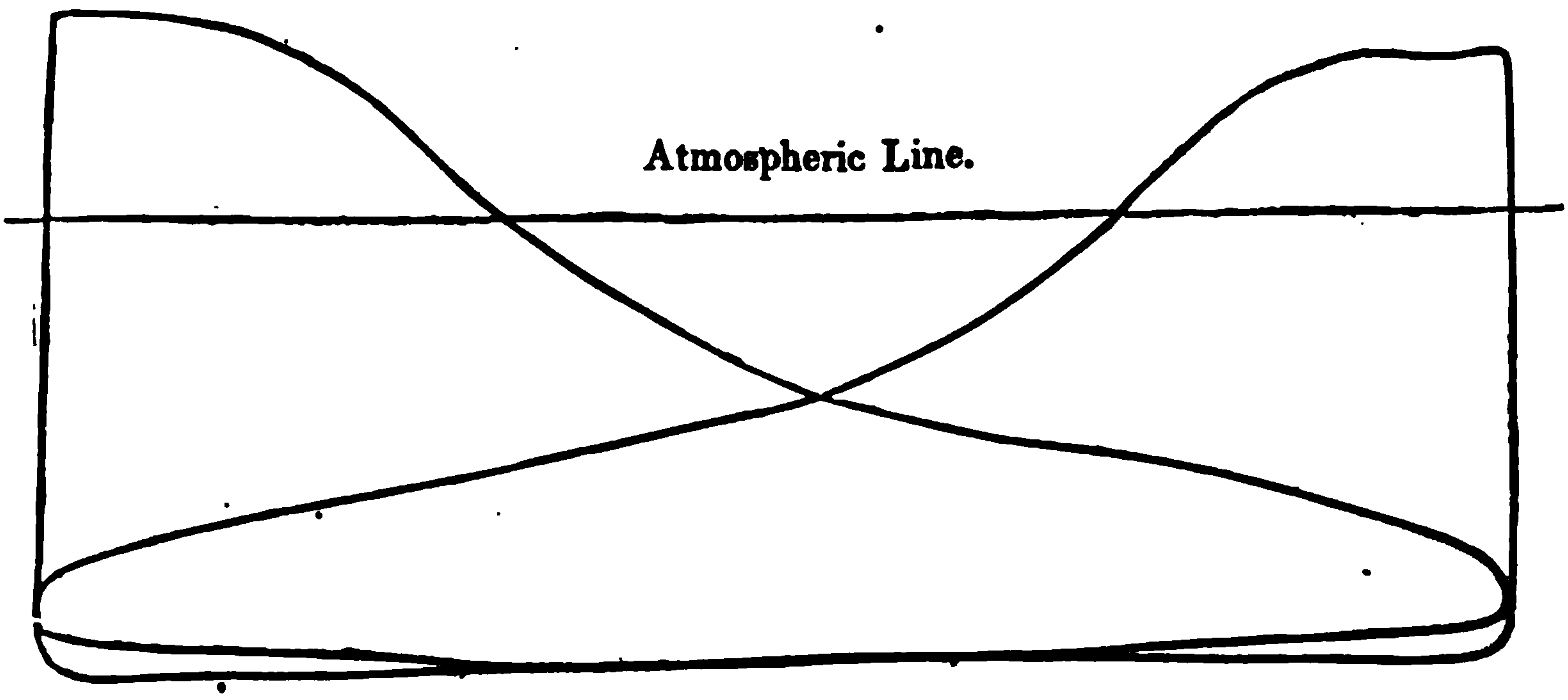
No. 3.—Taken August 4th, 1851. Sea smooth; fore and aft sails set; speed by patent log, 5·8 knots per hour; revolutions of the screw, 34 per minute; mean effective pressure per square inch of piston, 7·69 pounds. *Negative slip of the screw, 15·29 per cent.*



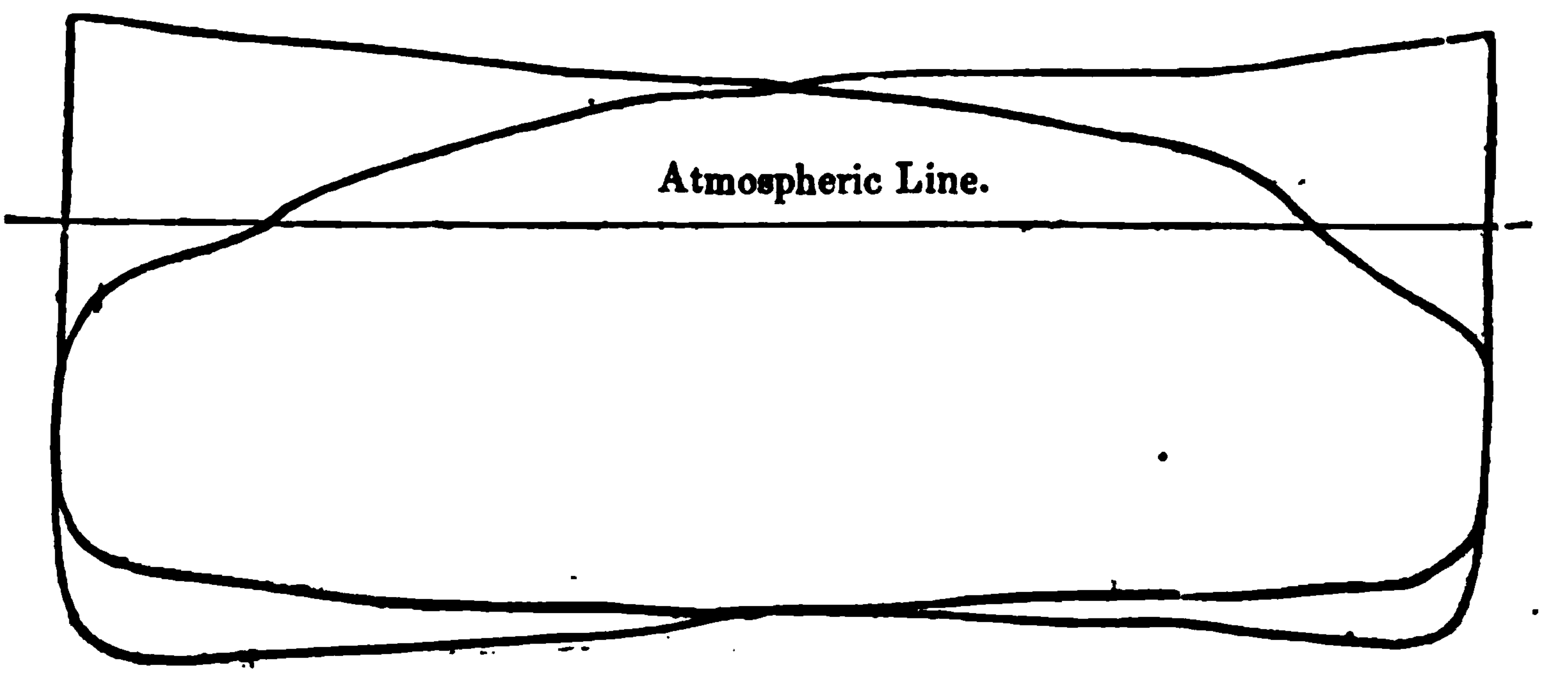
No. 4.—Taken August 5th, 1851. Sea smooth; calms and head airs; speed by patent log, 3·80 knots per hour; revolutions of the screw, 34 per minute; mean effective pressure per square inch of piston, 7·35 pounds. *Slip of the screw,* 24·46 *per cent.*



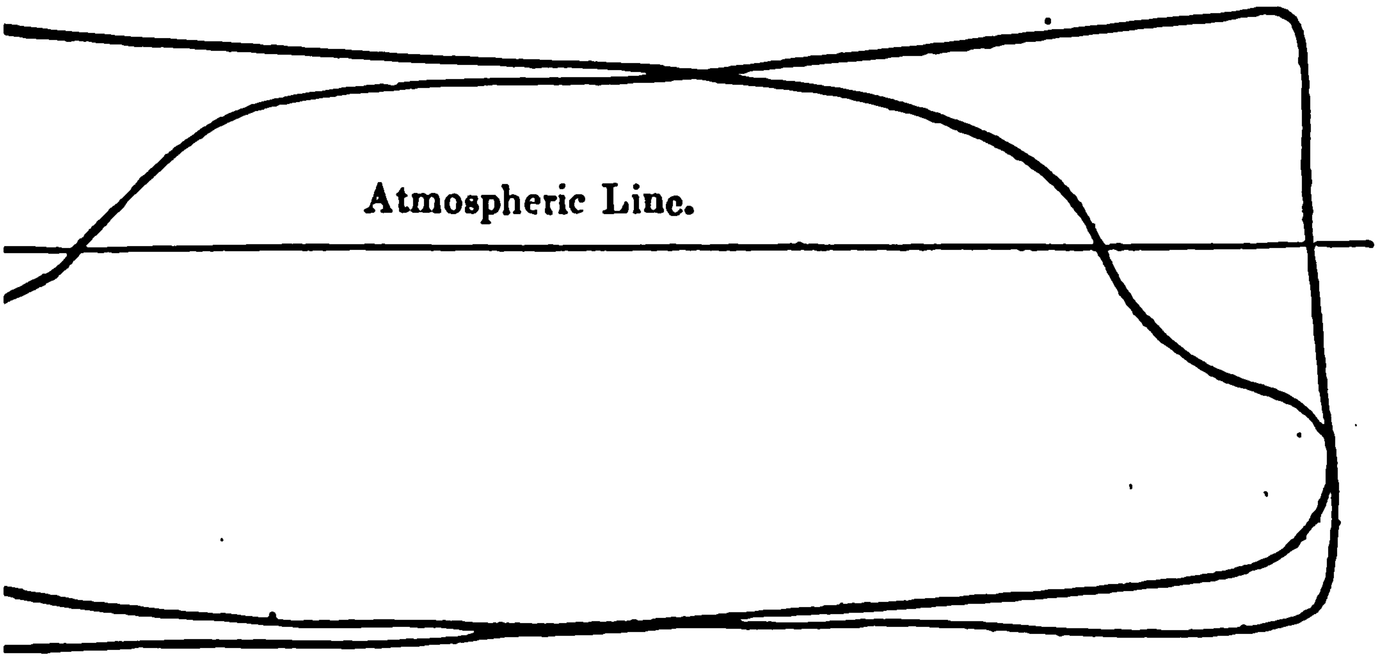
No. 5.—Taken May 4th, 1850. Sea and wind not noted; speed by patent log, 4·20 knots per hour; revolutions of the screw, 40 per minute; mean effective pressure per square inch of piston, 8·08 pounds. *Slip of the screw,* 29·04 *per cent.*



No. 6.—Taken August 5th, 1851. Sea and wind not noted; speed by patent log, 4·26 knots per hour; revolutions of the screw, 51 per minute; mean effective pressure per square inch of piston, 12·99 pounds. *Slip of the screw,* 44·34 *per cent.*



'aken August 2d, 1851, leaving Gibraltar for Lisbon. Sea smooth, strong free l sail set; speed by patent log, 10·60 knots per hour; revolutions of the screw, te; mean effective pressure per square inch of piston, 13·88 pounds. *Negative* *rew,* 11·94 *per cent.*



above diagrams, excepting No. 5, were taken on a passage altar to Lisbon, with a mean draft of about 19 feet, and show mance of the vessel under the most favorable circumstances, smooth sea and short run.

these favorable circumstances, the mean performance at sea, m alone, was for full power; that is, a mean effective pressure unds per square inch of piston, and 44⅗ double strokes of piston e, 5·08 knots; and for the reduced power used in calms and fine viz: a mean effective pressure of 7⅗ pounds per square inch of tained by cutting off at about ⅛th the stroke from the commence- : 33⅔ double strokes of piston per minute, a speed of 3·833 hour. These are slow speeds, and would not by any means be l satisfactory in our Navy. Every war steamship with us, having rage sea speed than 9 knots per hour, is pronounced a failure, gard to the comparative power of the machinery, consumption d size of vessel. It is thus that nearly all our Navy steamships s; but fairly compared relatively, power with power, fuel with size of vessel with size of vessel, I believe our Navy war steam- be found to give higher results, both in the generation of steam, of use in the engine, and application to the propelling instru- n can be found elsewhere, at home or abroad.

diagrams also show in a very striking manner, the effect of using njunction with the screw, and the existence of what is termed lip. A few remarks on this subject may be of use in this con- fficient data being luckily furnished by a trial of the *Arrogant* ames river.

r 8th, 1849, the *Arrogant*, drawing 16 feet 10 inches forward, et 9 inches aft, was tried at the measured mile in the Thames .. made at the rate of 7·25 knots per hour; revolutions of the ; per minute; mean effective pressure per square inch of pistons tor, 13·31 pounds; horses power developed by the engines, *Slip of the screw*, 22·23 *per cent.*

August 2d, 1851, the *Arrogant*, leaving Gibraltar for Lisbon, made, in smooth water, strong free wind, and all sail set, 10·60 knots per hour by patent log; revolutions of the screw, 64 per minute; mean effective pressure per square inch of pistons by indicator, 13·88 pounds; horses power developed by the engines, 767·45. The screw had now what may be termed a *negative* slip of 11·94 per cent.; that is, the speed of the vessel was 11·94 per cent. *greater* than the speed of the screw.

It may now be supposed that the screw, instead of assisting the progress of the vessel, was retarding it by dragging. That this was not the case, however, and that the screw under the above conditions was still actually propelling the vessel, will become evident from a consideration of the performance of the vessel in the Thames river, as given in the paragraph above.

During that performance, with 63 revolutions of the screw per minute, (slightly less than 64,) and a mean effective pressure of 13·31 pounds per square inch of pistons, (slightly less than 13·38 pounds,) there was developed by the engines sufficient power, (672·7 horses,) after overcoming the screw resistances of the front edges of the blades, and surface friction on the water, and engine resistances of friction and load on air pump, and also friction of load on the engines, to drive the vessel 7·25 knots per hour.

During the performance on the 2d of August, when the screw made 64 revolutions per minute, the above named screw and engine resistances may be considered practically the same as with 63 revolutions. The power now developed by the engines was 767·45 horses. But if the speed of the screw were now really less than the speed of the vessel, and retarding it by dragging, the screw would be assisted in its revolutions by the reaction of the water caused by that greater speed of the vessel; consequently there would not be required to be exerted by the engines, in order to overcome the screw and engine resistanees, as much power as was required when making the 63 revolutions in the Thames river; yet the total power now developed by the engines was greater than before, viz: 767·45, instead of 672·7, while a less power than before was required to overcome the screw and engine resistances. What then has become of the large remainder of this power? It must have been expended on some resistance, and the only resistances opposed to the power of a steam engine, in propelling a vessel by a screw, are the screw and engine resistances, the friction of the load, and the resistance of the vessel itself. We have seen, however, that but a small portion of the power developed by the engines was absorbed in overcoming the screw, engine, and friction resistances; the remainder therefore must have been expended in overcoming the resistance of the vessel; that is, in propelling the vessel; notwithstanding that the vessel was *apparently* going faster than the screw, and could not therefore be propelled by it. A little attention to what takes place in the passage of a body through water, will reconcile the contradiction.

It is familiar to all, that when a body passes through water, it leaves a vacuity behind, which is filled by the inrushing water. It is impossible in any case, that this vacuity can be made and filled simultaneously; time

is required for the operation, and the effect of time is to generate a current, or give velocity to the inrushing water: for as the water falls into the vacuity by its gravity, the speed of its current or its velocity will be proportional to the time required for the water thus to fall in. No matter how fine the after lines of a vessel may be, or how slow its speed, it must have, when in motion, *some* following current, and this current will be in some proportion to the fineness of the after lines and the speed of the vessel. The finer the lines and the less the speed, the less will be the velocity of the following current, because less time will elapse before the following water will have fallen in; or in other words, the following water will have a less distance to flow before it fills the vacuity.

An illustration of the same thing may be had by observing the eddy at the back end of a bridge pier placed in a current of water. A chip thrown into the current at the front end of the pier, close beside it, will not be carried straight on, but will close in behind the pier, and remain at rest.

With a hull of the *Arrogant's* proportions, moving through the water at the high velocity of 10·60 knots per hour, it is very probable the following current had a considerable velocity, and as the screw acted in and against this following current, it might have had a very *positive* slip, comparing the speed of the screw with the vessel's speed diminished by the speed of this current; while it had a *negative* slip, compared with the vessel's absolute speed through the water, supposing no following current to exist, and that the vessel and screw moved through the water in the same condition.

If the water were passing the screw at the vessel's speed, it would pass at the rate of 10·60 knots per hour; but if there were a following current of say 1·60 knots per hour, the water would only pass the screw at the rate of 9 knots per hour. The speed of the screw should therefore be compared with the latter rate, which, if it could be ascertained, would give the *true* slip of the screw, a slip that would always be found a *positive* one.

It must here be distinctly remembered, that a negative slip can only happen when the vessel has a high speed, and owes a considerable portion of it to a power additional to that applied to the screw, that of the sails, for instance; though it has frequently been reported to exist, when the vessel was being propelled by the screw alone. In these cases, it was manifestly the result either of inaccurate observations of distance gone, and revolutions made, or of a mistake in the pitch of the screw, reckoning it less than it actually was.

Supposing the motion of the vessel through the water to leave no vacuity behind it, the resistanee of the vessel would occasion a certain positive slip of the screw. Now, suppose this vacuity to exist, the bow resistance of the vessel would be increased by it, and by consequence the slip of the screw would be increased. Now, suppose also, that by reason of this vacuity, a following current be generated, which striking the screw diminishes again the increased slip; it is evident that this following current cannot impart *more* power than was absorbed in generating it; that is to say, that its additional resistance to the screw can only equal the additional resistance at the bow, thrown upon the screw by the genera-

tion of this current. Under the most favorable circumstances, then, the slip would remain the same, either with or without the following current; but in practice it cannot at all retain this equality, for the whole of the power bestowed in generating the following current, and resident in it, cannot be re-applied to the screw; in fact, but a small quantity can be so regained. To say, that in a vessel propelled by a screw alone, the vessel's speed could surpass that of the screw, would be to say, that in the case of a man wheeling a wheelbarrow, the speed of the wheelbarrow surpassed that of the man.

For the Journal of the Franklin Institute.

An Account of the Explosion of the Steamboat "Brilliant." By A. C— Jones, Esq., *Engineer.*

To the Committee on Publications.

Gentlemen:—Circumstances prevented my forwarding to you the account of the *last* explosion on the steamboat *Brilliant* at the time of its occurrence; it presenting some new features in recklessness, may even at this late day be acceptable to the readers of the Journal. As the same boat collapsed a flue last July, I will include both accidents (!) in this paper.

New boats are heralded with many safety contrivances; but not one states, (nor could many with truth,) that they have competent engineers. The advertisement of the new *Brilliant* ran thus:—"The Brilliant has more securities for the protection of passengers than any boat afloat, having the steam indicator, the water indicator, and in the event of fire, can flood the hold in an instant with steam, and is now offered to the public as the fastest boat on the river," &c.

The *Brilliant* was principally owned by planters on the "coast,"* and was intended to be one of the "crack packets;" from causes which it is not necessary to enumerate, she was not one of the "fast ones," unless the boilers were hard pushed; and to have this done, the captain being a "hot man," employed "*hot engineers.*"†

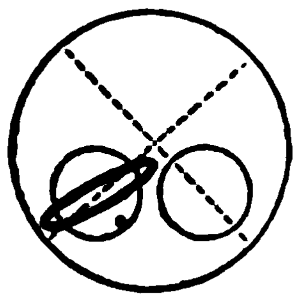
On the third trip, at 6 A. M., about five miles below the town of Plaquemine, the inboard flue of the larboard outside boiler collapsed, scalding several and killing four or five men. No injury was done to the boat.

This is an extract from a newspaper of the day:—"Captain Hart intends remaining here until a full judicial examination is had of the boilers, and the cause of the collapse. He has demanded the examination

*Both banks of the lower Mississippi river are so termed.

†This is the name applied to those miscalled engineers, whose rashness, coupled with ignorance, leads them to increase the pressure by overloading the safety valve, and by the hardest kind of firing, force the boat, at the risk of all on board, to go a little faster than their predecessors had done before. Strange to say, this worthless tribe bid fair to drive prudent engineers off the river.

U. S. Commissioner." Collapsing a flue being too trifling a the attention of the Commissioner, no examination was had, proper inquiry might have led to the prevention of the last :, as the cause was similar in both cases, EXCESSIVE PRESSURE. nal examination, I found the flue collapsed its whole length, torn from the boiler heads, (wrought iron.) The torn edges of presented a bright clean surface, and had every appearance of and tough; the after sheet is slightly laminated, but on the xcellent iron.* The water line in the boiler showed that the flush at the time of the collapse; and this is borne out by the f the three gauge cocks, the lowest one being *four inches above the flues.* As they understood the true policy of carrying a of water, the cause is easily arrived at. The objectionable most of the boilers on the river, is having the flues so large as tle water space between the flue and the shell. In this case, end it is under 1¾ inches; and it may have been still less at te parts between the heads. With hard firing, the heat acting lès of this film of water, causes it to be repelled, and the flue along that line becoming overheated, and the flue being the repares the way for a collapse, and sometimes an explosion. want of water space is a primary cause, is the inspection of collapsed flues, where the the boiler was ample at the time of the flues y; eight out of ten are flattened in a line drawn contracted space through the axis of the flues, earing or separation from the heads generally the collapse.



plosion.—Some time after the collapse, new boilers of heavier put into the boat, and the fall business commenced. Not yet to beat every thing on the river, (and the former collapse being caused a change of "*hot engineers*" from trip to trip. The last ne, the Captain employed at *extra wages*, "*the hottest man on* as second engineer. This man was in charge at the time of ion.

ember 28th, 1851, about 8½ A. M., while backing out from Dr. antation,† the second starboard boiler exploded as soon as the ere put in motion. The killed and missing exceeded sixty

period prior to the explosion, it was said by persons on board e, that the engineer on duty, in reply to the Captain's urging rease the speed, stated that the boilers would not bear more l accounts agree that they had been firing as hard as they could,

* the toughness of the iron is concerned, this will hold good; but it is of too for flues. I am not aware of any experiments having been made on flues, to istance to the crushing force tending to collapse; but it seems to be lost sight stiff iron would be preferable to the soft Western iron plates generally used

† likewise on a Sunday morning, and almost on the same spot where the for- occurred.

and using rosin freely at the time. *No steam was allowed to escape during the stop at the landing*, which was about four minutes.

There were five 42-inch boilers, with wrought heads, and 16-inch double flues, all being of heavy iron; the water space in these (like those they replaced,) was about two inches.

It appears that this boiler was torn asunder; the shell and part of the flues passing forward like a rocket over the starboard bow into the river; the remaining boilers are only displaced, the after ends having settled down; the doctor, steam drum, and pipes being slightly injured; the safety valve broken, and lever bent. Over and abaft the boilers, is a large breach in the cabin floor, through which passed a great quantity of water and steam, wetting every thing in the saloon to the after end of the ladies' cabin, much of the furniture being broken and destroyed. Twenty feet from the edge of the hole, lay two pieces of cast iron, being part of the flue return plate; fifteen feet further aft is the manhead, one bolt being broken; and near by is the lead gasket, which had formed the joint, and is crumpled up, but not melted. There were a few more fragments of iron on this deck.

Returning to the main deck, about five feet abaft the ends of the boilers, on the larboard side, partly across the boat, lay a piece of collapsed flue, doubled up in its length, so that its cross section has the form of a horse-shoe, U. On the platform, alongside of the starboard engine, is a piece of flue, (see sketch,) about two feet long, partly collapsed; the end, A, having by some means become partly shaved by contact with other iron. I send you a small spinicle broken off the flue; it is of a beautiful pink and orange color, caused by friction; and with it two pieces of lead; the small piece was taken from the chock joint of the remaining starboard boiler; the largest piece of lead is part of the chock joint of the other side of the exploded boiler. The lead in these chock joints, and the pieces of flues, prove that it was not for want of water that the boiler gave way; but simply by the excessive pressure at the time, from the steam being kept in, *although making fast*, and probably being increased at the instant by filling the cylinder quickly with steam, thereby creating a shock, which caused this overstrained boiler to yield.

Both engineers being dead, not the slightest attempt has been made to bring the surviving master spirit to justice, for this wilful and wanton destruction of life.

P. S. I shall forward you in a few days, the last explosion of the tow-boat *Mary Kingsland.*

New Orleans, February 23d, 1852.

For the Journal of the Franklin Institute.

Queries, by DR. HARE, *to* PROF. ESPY, *or to Meteorologists in general, induced mainly by certain generalizations in Espy's Report to the Naval Department.*

Having been called on officially to give his opinions on Prof. Espy's labors, Dr. Hare has preferred to publish them in full, rather than resort to a brief epistolary juridical communication.

The subjoined generalizations are quoted from the quarto pamphlet, entitled Espy's Report on Meteorology, page 5.

1. "The rain and snow storms, and even the moderate rains and snows, travel from the west towards the east in the United States, during the months of November, December, January, February, and March, which are the only months to which these generalizations apply."

2. "The storms are accompanied with a depression of the barometer near the central line of the storm."

3. "This central line of minimum pressure is generally of great length from north and south, and moves side foremost towards the east."

5. "The velocity of this line is such that it travels from the Mississippi to the Connecticut river in about twenty-four hours, and from the Connecticut to St. Johns, Newfoundland, in nearly the same time, or about thirty-six miles an hour."

7. "In great storms, the wind, for several hundred miles on both sides of the line of minimum pressure, blows towards that line directly, or obliquely."

10. "Many storms are of great and unknown length, from north to south, reaching beyond our observers on the Gulf of Mexico and on the northern lakes, while their east and west diameter is comparatively small. The storms, therefore, move side foremost."

11. "Most storms commence in the 'far west,' beyond our most Western observers; but some commence in the United States."

13. "There is generally a lull of wind at the line of minimum pressure, and sometimes a calm."

Queries submitted for the consideration of Prof. Espy, before making his next Report.

1. Has not experience established that vessels in approaching the Atlantic coast of the United States, are liable to be subjected, in the first instance, to a violent south-easter, then to a calm, or lull, followed by a north-wester, no less violent than the gale first encountered?

2. Whether the gale of 1836, of which the phenomena were recorded by Prof. Loomis, and published in the Transactions of the American Philosophical Society soon after, does not exemplify the origin and progress of such gales, by showing that the wind blew from between north and west, towards an oblong area of minimum barometric pressure, on one

side; while it blew towards that area on the other side, from the opposite quadrant of the horizon, between south and east.

3. Whether the observations thus recorded, do not show that the area of minimum pressure moved gradually from the north-west towards south-east, subjecting every station successively exposed to it, first to a south-easter, then to a lull, and finally to a north-wester?

4. Whether the course of this storm was not from north-west to south-east; and whether it did not, in this respect, agree with the well known gales, or hurricanes, above adverted to as universally called south-easters?

5. These premises admitted, Mr. Espy is requested to explain wherefore in one of his generalizations, he alleges that storms travel from *West* towards the *East* during the five winter months, instead of alleging that they travel from north-west to south-east, consistently with the observations of Loomis above mentioned?

6. Whether, if the language of the generalization were accurate, all gales experienced on the United States coast, would not blow from due east first, and from due west afterwards?

7. Whether there is not another distinct kind of storm, long known and universally recognised as the "north-easter" or "north-eastern gale," which has been distinguished from the south-easter, so called, by its direction, its longer endurance, lesser violence, and by its not being usually followed, after a brief lull, by a north-wester; nor any violent wind in a direction directly opposite to that in which it blew at the beginning of the storm?

8. Whether, moreover, co-existent with this north-eastern gale, there are not always upper clouds, which are to be seen occasionally through openings in the rainy strata, which upper clouds move slowly from the south-west in a direction nearly opposite to that which the scud pursues?

9. Whether, agreeably to the observations of Franklin, and general experience confirming them, our storms producing north-eastern gales do not travel from south-west to north-east, so that they are perceived earlier as the place of exposure is more to leeward?

10. Whether their traveling thus, does not warrant the opinion that they commence in the Gulf of Mexico, and are propagated gradually to the north-east along the Atlantic States, and the neighboring portion of the Atlantic ocean?

11. Whether the observations of Redfield do not establish, so far as they are reliable, that certain storms travel from the Gulf along the coast of the United States, and of course from south-west to north-east; and how these results are to be reconciled with the generalization in the report, or with the evidence adduced by Loomis?

12. Whether any absurdity which Redfield's inferences involve respecting the interior phenomena of his suppositious whirlwinds, justify distrust of the correctness of the route which they are represented to have pursued?

13. Whether we are to admit a generalization, which agrees neither with Loomis, Franklin, nor Redfield?

14. How can the observations of Franklin, confirmed by a very gene-

ral impression that they were sagacious and well founded, be reconciled with those made by Loomis, also highly esteemed, unless there be two kinds of storms, one of which travels from the *north-west* to *south-east*, the other from *south-west* to *north-east*?

15. Whether it can be correct to confound both of these kinds of storms under the one generalization of "*Storms moving from west to east*?"

16. Whether there is any difference in the direction of storms during the warmer months, justifying the restrictions to the colder season, of the generalization that storms move from east to west?

17. Do not tornadoes always move, whether in summer or winter, from north-west to south-east?

18. Do not thunder gusts almost invariably move from west to east, usually from N. W. to S. E.?

19. Whether there is any coincidence as to time between the prevalence of the terrific Norther of the Mexican Gulf Coast, and that of our north-east gales?

20. Whether they are not both consequent to the displacement of the warmer air lying on the Gulf, by the colder air of the territory of the United States, north or north-east of the Gulf, to whatever cause that displacement may be due?

21. Whether simultaneously with the existence of the norther on the western coast of the Gulf, there *is*, or *is not*, a north-easter blowing from the United States territory eastward of the Allegheny ridge, into the aerial estuary over the gulf?

22. There being three different climates within the territory of Mexico, according to the altitude of the localities throughout which they prevail, the lower being designated as the hot region, the middle as the rainy region, and the upper or table land of the City of Mexico, as the mild and dry region; whether it is not evident that the clouds of the Gulf do not ever cross the table land; but by their access to the intermediate region, cause its characteristic humidity?

23. Whether in point of fact, the climate of the table land of Mexico and that of the Gulf, are not independent of each other, so that however an ascent of the air of a portion of the Gulf, may render an horizontal afflux to supply its place necessary, the effect will be to draw the whole supply from the lower and comparatively cooler territory of the United States, lying to the north and east of the Gulf?

24. Whether, as the area of the Gulf reaches to nearly two-thirds of the size of the Valley of the Mississippi, and the territory of the Atlantic States, it should not have a great influence on the winds of the United States, and whether it does not justify a doubt of the correctness of any sweeping generalization which does not admit that great estuary to have any influence?

25. Whether the prevalence of gales supposed generally to occur about the time of the Autumnal Equinox, may not be explained by this fact, that the decline of the solar heat in September, cools the land more than the seas by which it is bounded; whence it follows that at this season of terrestrial refrigeration, there will be greater propensity for the air over the land, to displace that of the adjoining seas; and whether this process is not likely to be peculiarly influential in the case of the Gulf of Mexico,

and the territory of the United States, thus creating an unusual tendency to the production of north-east gales about the time of the equinox?

26. Whether the north-eastern gale does not cease to be a rainy wind at a certain distance from the United States coast, and if so, at what distance does it become a dry wind, a harbinger of a cloudless sky?

27. Whether this diversity in the character of the north-easter, may not be fairly ascribed to the facts above cited in relation to the Gulf of Mexico, since when the gale in question blows into the basin of that estuary, the air displaced by it being incapable of surmounting the barrier made by the table land and mountains, so as to get off to leeward, it has to flow back over the inblowing gale, furnishing thus the moisture which forms its well known attribute?

28. Whether the fact that, beyond the range of our Atlantic coast, there is no such basin and barrier, is not the reason of there being no moisture associated with winds having a north-eastern direction, since in that case there is no barrier to cause the moist air displaced to flow in an opposite course above that of the displacing current below?

29. Whether the general tendency of the wind, in the upper region, to move from south-west to north-east, over the United States territory, does not fortify the idea that the warm and moist air, displaced from the Gulf, must pursue an opposite route to that of the lower wind, by which it may be supplanted?*

Queries respecting the conflicting explanations of the causes of Tornados and and Water Spouts.

The preceding queries are intended to draw attention to those points of view in which the generalizations of Prof. Espy are apparently irreconcileable with well known facts, extensive experience, or the observations of other meteorologists; but as the learned Professor mingles references to his theory incessantly with his observations, I request that he answer some queries bearing thereupon.

I therefore propose the following inquiries:

Whether there are not two well known modes of electrical discharge, by which bodies oppositely electrified are made to neutralize each other, in one of which, electricity passes in a spark, in the other, is conveyed from one surface to the other, by the motion of some intervening body; whence the alternate motion of clappers between bells, of pith balls, or puppets between disks, and of blasts of air from electrified points.

The existence of these modes of discharge being admitted, and also that one of them has been called the spark, or diruptive discharge, the other, the carrying or convective discharge. I ask whether any charge whatever, may not be neutralized either by the convective or diruptive process, so that the one is commutable for the other by a slight diversity of distance.

Whether in every case of the existence of an electric charge, attraction does not take place between the surfaces, or bodies employed to hold it?

* Prof. Espy may probably consider his generalizations as justified by the plotted record of his observations, but the examination of them has not created that impression. He has *lectured and* reported upon his own theory and observations, without bringing those of his *predecessors* or contemporaries sufficiently into view.

Whether it does not follow, that wherever there can be a charge competent to produce the diruptive spark discharge, there must be a competency to produce the convective discharge?

These premises conceded, and it being admitted that lightning is a diruptive discharge on a gigantic scale, does it not follow that there must be a gigantic convective discharge in nature upon a scale of commensurate magnitude?

Let Mr. Espy say where that convective discharge is to be found, if it be not in the tornado or water spout?

Let him say in what respect the features of the tornado are discordant with those of a convective electrical discharge?

Let him say why the phenomena observed by Allen, are not a magnificent illustration of the alternation of the convective and diruptive discharge?*

Is not Prof. Espy aware that the immediate mechanical causes of the devastation produced by tornadoes and water spouts, were never well ascertained prior to the observations made respecting the tornado of New Brunswick in June, 1835, especially by means of the survey made by Professor A. D. Bache and himself.

Moreover, that agreeably to the observations and survey alluded to, it was shown that tornadoes consist of an upward blast of air about the axis, and horizontal confluent blasts from all quarters to supply the upward blast, the axis having a progressive velocity?

While at that time, by Prof. Espy, the ascentional force was attributed to a buoyancy arising from the heat, evolved by aqueous vapor in condensing within the upper part of a rising column of air, was it not by me ascribed to a discharge of electricity between the earth and sky, and superseding the discharge in the form of lightning? Did not Mr. Espy know that this explanation was the subject of a memoir published in the transactions of the American Philosophical Society, in vol. v. 1836; subsequently published in Silliman's Journal, vol. xxxii, 1837?

As the volumes of the Society above mentioned are invariably sent to the Academy of Sciences, at Paris, soon after being issued, was not Prof. Espy aware that the volume containing my memoir must have been in the library of that academy, when in 1840 his theory was submitted to the committee appointed to report upon it.

In his book, entitled "Philosophy of Storms," an account is quoted from Peltier, of a tornado which occurred at Chatenay, near Paris, by which a chateau and its park were devastated. Was not Professor Espy informed that this account of Peltier was comprised in a report made under the following circumstances:

*The observations of Mr. Allen were stated in the following words:—"Being within a few yards of this spot, I had an opportunity of accurately noting the effects produced on the surface of the water. The circle formed by the tornado on the foaming water was about 300 feet in diameter. Within this circle the water appeared to be in commotion, like that in a huge boiling cauldron. The waves heaved and swelled, whenever the point of this cone passed over them, apparently as if some magical spell were acting upon them by the effect of enchantment. *Twice I noticed a gleam of lightning, or of electric fluid to dart through the column of vapor. After the flash, the foam of the water seemed immediately to diminish for a moment, as if the discharge of the electric fluid had served to calm the excitement on its agitated surface.*"

The chateau being insured against damage done by thunder storms, indemnity was claimed; but the insurers objected, that the tornado was not a thunder storm. Hence the question was referred to Arago, President of the Academy. This distinguished savan, being unable to attend personally, deputed Peltier; who, after an investigation of the phenomena, and examination of witnesses, adopted my explanation, so far as this, that the tornado, by intervening between the earth aud sky, supersedes the more usual mode of discharge by lightning.

When the Professor was submitting his views to Mr. Babinet, was he ignorant of the following facts, which I afterwards learned from the parties themselves: that Arago was so occupied with business to which he was subjected by the Government and the Academy, that he could not give any attention to Prof. Espy's application; that Pouillet not agreeing with Babinet, and Arago not attending, left to Babinet exclusively to report upon the Espyan theory; and that Babinet, more distinguished as a profound mathematician, than as a well informed meteorologist, made his report in ignorance of the existence of my memoir, of Peltier's report, or the consequent judgment against the insurers?

Is it not evident, therefore, that the report made by Babinet, and signed by Arago and Pouillet, was obtained upon exparte representations through neglect and ignorance, and that either on the one hand, gross injustice had been done to the insurers in being made to pay for it as an electrical storm, or on the other, the report did injustice to the cause of scientific truth, in ascribing it to heat?

Is it not evident that when a balloon rises it is pressed up, by the wedging in under it of the heavier surrounding air, and that this, while it presses the balloon upwards, presses downwards on the column of air immediately under it?

If this be a true representation of the process by which a balloon is elevated, how could the ascent of a balloon, however great, at the level of the clouds, disturb the column of air supporting the balloon, so low down as the base resting on the terrestrial surface.

Does not this reasoning apply equally to a mass of air warmer than that surrounding it, in consequence of the latent heat yielded by condensation of the contained vapor?

Is not this the reason why the inflammation of a stratum of carded cotton above the mouth of an inverted open necked bell glass, produced not the slightest movement in fibres of the same material, situated on a wire gauze within the bell immediately over the bore of the neck?

Are not all the Espyan requisites for the production of a tornado to be found in the upward current of air over equatorial regions, by which the trade winds are induced? If so, wherefore does not a tornado prevail there, as enduring as that upward current?

Queries to Meteorologists generally.

The following queries are not made with any reference to Espy's theory or generalizations; but with a view to complete the series which has at this time been suggested to me as worthy of the attention of meteorologists.

s it not follow that whenever any portion of the atmosphere is :d positively, or negatively, the aerial particles must undergo a cor-.ding rarefaction from the reciprocal repulsion consequent to a simi-te of electrical excitement? May not this be one cause of a buoy-ınd consequent ascentional power, producing a penetration of the of frost, by the lower strata of the atmosphere?

enever electrical repulsion tends to counteract gravitation, is it not able that barometrical pressure should be diminished, and may not tely charged aerial masses by rushing together, sustain a diminution ıme, and cause a precipitation of vapor as rain, by super-saturating ıce within which they commingle?

s above suggested, a diversity of electrical excitement be followed responding variations of the density of the air and of the space ed by it; whenever by such means a dilatation of bulk occurs in a ıf the atmosphere, will it not take up any moisture to which there e access sufficient to saturate the additional space occupied; and ver the opposite change of diminution of volume ensues, will it posit a proportionable quantity of moisture?

ot the action of the air in this respect in taking up and giving out re, analogous to that of a sponge, which absorbs or gives out any nding liquid, accordingly as it may be allowed to dilate by its own ity, or made to contract by mechanical compression?

' not each globule of water in a cloud be inflated with air like a :, while this bubble may be expanded by electrical repulsion, so as nore buoyant, than if it were electrically neutral, and may not this cause of the buoyancy of clouds?

' not a buoyancy thus arising, be one source of ascentional power ng those upward currents which cause rain?

well known that clouds intercept the radiant heat given off by the rial surface to such an extent, that white frost, which is always the uence of radiation, only takes place when the sky is clear. Does :ollow that the clouds must acquire heat by terrestrial radiation, so e air with which they are associated must consequently be made r and more buoyant than it would otherwise be?

e we not reason, then, to infer, that the heat arising from terrestrial on is one of the causes of the buoyancy of clouds?

ertheless, generally, is not the persistence of clouds only appa-Are they not formed as the vapor, in any rising column of air, s the level where there is sufficient refrigeration to condense it; but the cloud thus formed, dissolved usually by the air above, of which r point is so low as to enable it to take up the precipitated vapor? not the phenomena analogous to those of the fog or cloud, which pear to surmount *persistently*, the escape pipe of a steamboat boiler, h this is manifestly the effect of a successive condensation of suc-g portions of the aqueous vapor?

Dimensions and Computations of the Pittsburg and Cincinnati Packets, and some of the other large Steam Vessels which navigate the Ohio River, above or below the Falls, extracted from the Report of Proceedings in the matter of the Wheeling Bridge Case; being a portion of the Report of Wm. J. McAlpine, Esq., C. E., *to* Hon. R. H. Walworth, *Commissioner of the Supreme Court of the United States.*

PARTS MEASURED, in feet and in decimals of a foot.	Pittsburg and Cincinnati Packets.							Louisville and Cincinnati Packets.		Louisville and New Orleans Steamboats.				Steubenville and Wheel'g Packet.	Louisville and Frankf't Packet.
	Clipper No. 2.	Brilliant.	Keystone State.	Buckeye State.	Messenger No. 2.	Cincinnati.	Hibernia No. 2.	Ben Franklin.	Telegraph No. 2.	Bostona.	Alex. Scott.	Peytona.	Magnolia.	Cabinet.	Blue Wing, No. 2.
Lengths—															
Stem to stern	215·	227·	250·	264·	244·	242·	226·	255·	..	265·	266·	265·	295·	172·	153·
Stem to promenade deck	28·	28·	28·	28·	29·	28·	28·	..	..	25·	26·	28·	35·	27·	21·
Stem to boilers	59·	71·	73·	81·	71·	73·	73·	80·	..	75·	82·	83·	88·	55·	40·
Stem to wheelshaft	145·	157·	162·	172·	160·	157·	152·	165·	..	173·	169·	177·	186·	129·	108·
Of pilot house	9·	8·	8·	10·	8·	8·	8·	11·	..	12·	10·	14·	16·	..	10·
Breadths—															
Of beam	32·	32·	30·	30·	31·	31·	28·	34·	..	34·	34·	33·	35·	27·	27·
Outside of guards	54·	58·	57·	56·	58·	55·	54·	66·	..	66·	69·	69·	72·	..	37·
Of pilot house	15·	15·	12·	12·	12·	12·	14·	13·	..	14·	13·	13·	16·	..	10·
Depth of hold	6·9	7·5	7·2	7·8	7·2	7·4	7·	7·	..	7·5	8·	8·	9·	5·6	5·7
Draft when light	3·2	3·5	3·3	3·5	2·9	3·3	3·5	..	3·5	4·7	3·8	..	4·4	1·8	2·7
Heights above the surface of the water when light—															
Main deck	4·4	4·0	4·3	4·5	4·2	4·3	3·5	3·3	4·2	3·5	4·	4·3	6·0	..	3·7
Promenade deck	16·8	16·	16·	16·	15·	16·	14·5	15·	17·8	15·8	16·3	18·3	21·3	..	10·

Cross braces	28·7	..	27·7	34·1	26·8	26·7	43·5	29·5	..	29·5	32·	30·8	38·2	..	25·3
Hog chain braces	..	51·4	..	52·4	..	..	..	..	..	..	..	..	..	..	..
Paddle Wheels—															
Diameter	25·	29·5	30·	31·3	30·	32·6	26·	27·5	30·	30·	30·	30·	40·	22·	25·
Diameter of shaft	1·	1·3	1·3	1·4	1·3	1·3	..	..	..	1·3	..	..	1·5	..	..
Length of bucket	11·3	11·4	12·	11·5	12·	11·	12·	14·7	12·	14·	15·	16·	12·2	8·3	7·
Width of bucket	2·	2·2	2·7	2·6	2·5	2·3	2·6	3·	3·	2·5	2·3	2·5	2·4	2·2	2·
Number of sets of arms	16·	20·	19·	20·	18·	18·	18·	18·	18·	18·	20·	18·	26·	15·	14·
Revolutions per minute	22·	20·	19·	18·	19·	18·	19·	16·	18·	20·	18·	16·	16·	24·	23·
Chimneys—															
Centre of flues ab. surf. water	9·7	9·5	9·5	10·	9·7	9·8	8·1	8·6	9·5	8·6	9·2	9·8	12·	8·2	8·3
Hinges " "	54·5	59·	27·	26·8	64·	28·9	53·7	..	..	..	..	..	..	..	23·6
Top of, " "	66·7	71·5	77·5	74·8	74·	84·7	63·7	72·7	79·8	85·8	87·5	73·8	90·4	56·	55·6
Top of, above flues	57·0	62·0	64·0	64·8	64·3	66·9	55·6	64·1	66·3	77·2	76·3	64·0	78·4	47·8	47·3
Distance between chimneys	..	18·5	18·	..	..	17·8	15·3	..	..	..	..	..	..	..	..
Diameter of	3·66	4·55	4·96	5·50	4·45	4·45	4·5	4·6	4·85	4·75	5·	5·1	5.	..	3·55
Width of iron rings	2·04	2·07	2·17	2·06	2·04	1·75	2·0	2·0	2·0	1·92	2·	1·83	2·0	..	3·56
Boilers—															
Number	4·	5·	4·	5·	5·	4·	5·	6·	5·	5·	6·	6·	6·	2·	3·
Length	26·2	26·5	30·8	30·2	30·	28·	27·	32·	30·	34·	31·	32·5	30·	26·	22·
Diameter	3·08	3·33	3·45	3·5	3·37	3·33	3·42	3·33	3·33	3·5	3·5	3·5	3·5	3·5	3·33
Distance from centre to centre	3·7	4·	4·1	4·2	4·2	4·1	4·	3·7	4.	4·	4·2	4·2	4·1	4·	4.
Number of flues	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·
Diameter of flues, inside	1·08	1·29	1·45	1·45	1·33	1·27	1·17	1·17	1·33	1·33	1·21	1·25	1·33	1·33	1·25
Draft space, back end	0·83	0·70	1·00	0·75	0·90	1·00	0·90	0·92	0·75	0·75	..	..	..	..	..
Draft space, over bridge	0·42	0·42	0·5	0·64	0·60	0·58	0·50	0·50	0·70	..	..	..	0·83	0·46	..
Pressure of steam, in lbs.	150·	140·	140·	140·	150·	150·	150·	130·	160·	145·	140·	125·	125·	135·	130·
Heaters—															
Number	1·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	2·	1·
Diameter	2·	2·7	2·9	2·9	2·7	2·3	2·5	1·7	2·	2·5	2·3	2·	2·9	1·5	2·2
Length	4·	8·2	8·2	10·5	10·2	8·3	7·5	6·	6·	6·	8·	8·	8·	5·	6·3
Grate Bars—															
Length	4·	4·	4·	4·1	4·1	4·	4·	4·	4·	4·	4·1	4·1	4·	4·1	4·
Thickness	0·07	0·06	0·06	0·08	0·09	0·07	0·07	0·12	0·12	0·17	0·11	0·17	0·06	0·17	0·12
Spaces, width of	0·07	0·07	0·07	0·08	0·08	0·07	0·16	0·08	0·08	0·06	0·08	0·06	0·06	0·11	0·08
Depth of, below boiler	1·75	1·54	1·62	1·58	1·50	1·67	1·67	1·83	1·67	1·67	1·83	1·75	2·	1·04	1·67

PARTS MEASURED, in feet, and in decimals of a foot.	Clipper No. 2.	Brilliant.	Keystone State.	Buckeye State.	Messenger No. 2.	Cincinnati.	Hibernia No. 2.	Ben Franklin.	Telegraph No. 2.	Bostona.	Alex. Scott.	Peytona.	Magnolia.	Cabinet.	Blue Wing, No. 2.
Engines—															
Number of cylinders .	4·	2·	2·	2·	2·	2·	2·	2,	2.	2·	2·	2·	2.	2·	2·
Diameter of do. . .	1·33	2·19	2·12	2·42	2·33	2·	2·33	2·50	2·17	2·21	2·08	2·50	2·50	1·42	1·46
Length of stroke .	7·	8·	8·	8·	7·50	7·	8·	8·	9·	9.	10·	10·	10.	5·50	7·
Cuts off at . . .	5·25	4·	3·5	5·	4·6	3·5	5·	4·	6·75	5.	6·25	6·25	6·25	2·75	4·38
Length of connecting rods	24·	26·	26·	26·	26·	26·	24·	26·	27·	29·	30·	30·	35·	20·	22·
Size of steam ports, in sq. ft.	..	..	..	0·2552	..	..	0·1872	..	..	..	..	..	0·3886	..	·1512
" escape ports .	..	..	..	0·3984	..	..	0·2988	..	..	..	..	..	0·4814	..	·1800
Diameter of steam valves .	0·33	..	..	0·56	0·50	..	..	0·58	0·62	0·54	..	..	0·71	0·33	..
" escape valves	0·46	..	..	0·62	0·58	..	..	0·67	0·71	0·62	..	..	0·79	0·43	..
" steam pipe .	2·	2·	2.	..	..	..	..	..	..	..	..	..	..	..	..
" branch pipes	0·40	0·67	0·56	0·65	0·65	0·50	0·65	0·65	..	0·67	0·67	0·70	0·67	0·34	0·50
" exhaust pipe	1·00	0·90	1·10	1·10	1·10	0·80	1·10	1·00	1·00	0·9	1.00	1·20	1·00	0·50	0·80
Engines to work pumps—															
Diameter of cylinder .	0·75	1·00	..	0·75	0·75	0·92	0·67	0·75	0·75	0·67	0·75	0·50	0·92	0·58	0·58
Stroke of do. .	2·00	1·50	..	1·83	1·50	1·25	1·83	1·42	1·75	1·42	3·00	1.58	2·25	1·25	
Number of cold water pumps	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Diameter of do. do.	0·46	0·46	0·52	0·54	0·50	0·48	0·42	0·58	0·44	0·46	0·67	0·46	0·58	0·33	0·37
Stroke of do. do.	..	..	..	1·42	1·29	1·50	1.00	1·50	1·75	1·17	2·00	1·58	1·67	0·71	
Number of hot water pumps	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Diameter of do. do.	0·46	0·46	0·52	0·50	0·50	0·48	0·42	0·33	0·42	0·37	0·37	0·33	0·50	0·29	0·29
Stroke of do. do.	..	..	..	1·42	1·29	1·50	1·00	1·50	1·75	1·17	2·00	1·58	1·67	0·71	
Fuel consumed per trip—															
Coal, bushels . .	3200	4000	3000	4000	3000	3000	2500	..	..	..	..	..	..	100.	
Wood, cords . . .	None.	50	72	50	60	20	80	..	..	660					
Average speed—															
Passage down, hours .	36	36	36	30	42	38	40	9	10	132	144	..	..	6	
Passage up, do. .	52	52	52	50	52	52	52	15	15	132	144	..	..	3	
[illegible] four mile current .	10	10	10	12	9	10	10	10	12	12	11	..	..	7	
[illegible] running	1848	1846	1850	1850	1848	1850	1847	1848	..	1848	..	..	1850	..	1850
		[illegible]	516·4	617·2	526·0	535·3	420·1	594·1	〃	481.	710·	686·4	918·4	244·2	216·9

Sectional area, in sq. feet—															
Of immersion when light	96·4	107·8	94·1	102·7	82·85	..	94·0	..	..	153·9	123·3	..	150·0	46.6	68·7
Of two chimneys . .	20·82	32·24	38·32	47·00	30·82	30·82	31·38	33·10	36·66	34·70	38·64	40·36	..	..	19·58
Of all the flues . .	7·36	13·00	13·20	16·70	13·90	10·08	10·80	12·96	13·90	13·90	13·80	14·76	16·68	5·56	7·38
Over bridge wall . .	17·06	22·72	20·25	26·95	..	22·73	..	28·12	24·62						
Area in square feet, of—															
One bucket of wheel .	22·66	25·69	33·00	30·70	30·00	25·63	32·04	44·25	35·04	35·00	34·95	40·00	29·64	19·16	14·16
Grate surface . .	59·2	80·	65·6	86·1	86·1	65·6	80·	88·8	80·	80·	93·32	93·32	98·40	32·80	48·
Spaces in grate . .	28·36	41·64	36·25	41·16	39·11	..	53·9	23·92	30·93	20·52	41·41	25·66	47·80	12·02	18·13
Whole heating surface .	1343·	1927·	1935·	2394·	2270·	1614·	1887·	2649·	2218·	2560·	2667·	2839·	2716·	786·	947·
Contents, cubic feet—															
Between grate bars and boilers	127·	160·	137·	176·	173·	139·	170·	199.	170·	173·	238·	230.	243·	46·	99·
Boilers, for water and steam	569·	775·	718·	914·	889·	669·	919·	1217.	858·	1125·	1320·	1353·	1191·	347·	398·
Ratio between—															
Buckets & immers'n of vessel	2·13	2·09	1·43	1·67	1·38	..	1·47	..	..	2·20	1·76	..	2·53	1·22	2·43
Grate and effective heating surface . . .	1 to 14·80	1 to 15·54	1 to 18·90	1 to 17·84	1 to 16·92	1 to 15·91	1 to 15·47	1 to 19·49	1 to 17·82	1 to 20·79	1 to 16·96	1 to 17·99	1 to 17·92	1 to 15·55	1 to 12·77
Contents of boiler and effective heating surface	1 to 1·53	1 to 1·60	1 to 1·73	1 to 1·68	1 to 1·64	1 to 1·56	1 to 1·35	1 to 1·42	1 to 1·66	1 to 1·48	1 to 1·33	1 to 1·37	1 to 1·48	1 to 1·47	1 to 1·54
Distance traversed by hot air and gases . . .	107·	112·	123·	122·	121.	120·	107·	125·	123·	142·	135·	126·	135·	97·	88·
Fuel consumed in pounds of coal and its equivalent in wood,															
Per hour	2545·	3892·	3409·	4281·	3032·	..	2989·	..	..	3125·	..	..	..	1166·	
Per second . . .	0·71	1·08	0·95	1·19	0·84	..	0·83	..	..	0·87	..	..	..	0·32	
Per hour on each square foot of grate surface	43·	48·65	51·97	49·72	35·22		37·37	..	..	39·06	..	..	..	35·57	
Nominal horse power of all the engines—															
At 100 lbs. steam, per inch	800·	781·	659·	928·	866·	514·	913·	816·	895.	927·	862·	1104·	1104·	267·	378·
At pressure of steam, stated by engineer of boat .	1200·	1093·	922·	1300·	1212·	720·	1279·	1060·	1432.	1344·	1207·	1324·	1380·	360·	491·

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* Dr. L. Turnbull.

Continued from page 284.

Improvements in Electro-Telegraphic Apparatus and Machinery. Wm. Thomas Henley, and David George Foster, of Clerkenwell, London, January 10th, 1849.—The invention consists, *Firstly*, in certain improved arrangements of electric apparatus, whereby a visible index hand or pointer is directly acted upon by a single magnet suspended within the sphere of influence of an electro or other magnet, having each of its extremities converted or resolved into two or more poles.

Secondly, Our invention consists in keeping the magnetic bar, needle, or pointer in one position for any length of time, or imparting to such bar, needle, or pointer, any number of distinct deflexions or movements, by means of the current or currents derived from magneto electricity, and also in making use of the residual magnetism to act upon the needle on its return to its stationary position, instead of the force of gravity; that is to say, in moving the needle in one direction by the induced current, and bringing it back to its stationary position by the action of the reversed inductive current, whereby the motions of the needles are increased in rapidity, and rendered much more marked and distinct than heretofore.

Thirdly, Our invention consists in certain improved arrangements of the magneto-electro apparatus used in electric telegraphs, whereby two distinct currents may be derived from the same magnet, and the reversed current can be made of equal intensity with the primary induced current, and single or double currents may be sent, as required, through any required number of instruments at different stations.

Fourthly, Our invention consists in the improved apportionment of the signs or symbols used in electric telegraphs. [The object of this new apportionment is to reduce the number of movements requisite, and it seems very successfully carried out. We pass over the details, which would occupy more space than we can afford to them.]

Fifthly, Our invention consists of an improved compound of gutta percha, suitable for the insulation, covering, and exterior protection of wire and other metallic substances employed to transmit currents of electricity. We mix the gutta percha nearly in equal portions, by weight, with sand which has been ground or pounded to a degree of fineness exceeding that of the finest natural sand, or with the siftings of glass paper manufactories, or glass fragments and particles of any sort, reduced to a similar degree of fineness, and this either by mixing the pulverized sand or glass with the gutta percha in a state of solution, or while in a plastic state.

Sixthly, Our invention consists in the employment of a current reverser of a peculiar construction, whereby we are enabled to dispense with the use of magneto apparatuses for the purpose of deriving currents of electricity in the manner before described, and to substitute in lieu thereof, voltaic batteries, such as are commonly in use for the purpose of transmitting currents of electricity along metallic conductors, such reverser

completing the circuit twice during its motion, by the transmission of a reversed current, in the manner of the magneto machines.

Seventhly, Our invention consists in the employment, in manner following, of currents of electricity to regulate and govern the motions of time-keepers, whether the same be influenced by a current from a distant station or otherwise. We make use for this purpose of the currents of either magneto or voltaic electricity; but obtained in the latter case without the aid of soft iron from two hollow coils of insulated wire affixed to the pendulum of the regulator, and surrounding the poles of two permanent horse-shoe magnets, which coils vibrate in the direction of their length alternately, off one pole on to the other, a current being induced at each vibration, but in opposite directions.

Claims.—1. We claim in respect to electric telegraphs, and to all machines or machinery, to the moving of which electricity is or may be applied, the different arrangements of apparatus described under the first head of this specification, in so far as respects the division of each pole of the magnet into two or more poles, and the direct action on the index hand or pointer, or other recipient of the magnetic influence.

2. We claim the mode of causing the index hand or pointer to be permanently deflected (that is, for any length of time required) in one direction, and bringing it back by the reversed current to its original stationary position, and keeping it there, as before described.

3. We claim the three several magneto-electric apparatus described under the third head of this specification, in so far as regards the peculiar arrangements and combinations, whereby two distinct currents are obtained from the same magnet, the reversed current is obtained of equal intensity with the primarily induced current, and either single or double currents may be sent as required through any number of instruments at different stations.

4. We claim the improved system of visible symbols suitable for electric telegraphs, before described and exemplified.

5. We claim the employment in electric telegraphs, and in all other machines and machinery to the moving of which electricity is applied, of the peculiar compound of gutta percha, before described, for purposes of insulation and protection.

6. We claim the improved current reverser, before described, in so far as respects the effecting by a single depression of the lever or key, the completing, reversing, and breaking of the electric current.

7. We claim the application of currents of magneto-electricity to regulate the motion of time-keepers in the peculiar manner described under the seventh head of this specification; that is to say, in so far as regards the obtaining of the currents from the inductive action of permanent magnets and coils of insulated wire without the aid of soft iron. And,

8. We claim the application to the regulating of time-keepers of currents of electricity (whether magneto or voltaic) transmitted from a primary or standard clock by the improved apparatuses and instruments, and by the peculiar modes before described, that is to say, in so far as regards the alternate transmission of the current in opposite directions, and the different mechanical arrangements whereby that is effected.—*London Mech. Mag., Vol. L, p.* 148.

Henley's Magneto-Electric Telegraph.—An experiment has been made under the direction of the French Government, to test the efficacy of Mr. Henley's Magneto-Electric Telegraph, which is worked without batteries of any kind, and at a fraction of the cost of the voltaic system. The line of railway assumed for the trial was that from Paris to Valenciennes. The persons present at the two stations were, the director of the French telegraph, a Commissioner appointed by the Belgian Government, and a few others. The distance is 180 miles, being the longest telegraph line in France. After a most satisfactory series of trials on the single distance, first with full power, and afterwards with one-twentieth of the power, the wires were connected so as to treble the total length of wire, making 540 miles to and from Paris and back; the magnetic message being communicated through the first wire, back by the second, through the third, and back again by the earth. It was not anticipated that the magnet could possibly work through this resistance; but in fact, it is alleged it was worked as directly and rapidly as when only made to traverse the 180 miles with full power. The ordinary telegraph, with battery power, used by the French Government, was then put in requisition, but not the slightest effect was produced. On the single distance even, a signal was not obtained for several minutes, owing, it is said, to some fault in the batteries. The Government officers and others inspecting the working operation, expressed themselves thoroughly satisfied with the series of trial.—*London Mining Journal*, 1850.

Highton's Improvements in Electric Telegraphs.—On February 7, 1850, Mr. Edward Highton, Engineer, Middlesex, England, patented the following arrangement of telegraphic circuits: "Two or more signalizing instruments, and to each instrument two batteries are connected, so placed in regard to their poles as to work in opposite directions. A method of working electric telegraphs by the inductive influence of electro-magnets, making the dials, which carry the letters or characters, movable, instead of the pointers. As many of his claims are old, I only notice such as are important: he incloses his wires in flexible materials, such as lead; this was done in 1844, by Prof. Morse. The protecting the telegraphic wire by enveloping them in masonry; also, enameling the exterior surface of gutta percha coating of electric wires by rubbing the surface over with naphtha, or other solvents, and then smoothing it down by a cushion or brush.

A method of constructing the supporting posts out of a number of planks firmly united together, instead of out of one piece of timber, cut taperingly, as has hitherto been the custom.

Removing the atmospheric electricity which is collected during storms or other atmospheric disturbances, by causing the line wire, or a bar of iron connected thereto, previously enclosed in bibulous paper, or other fabric, to pass through a mass of iron filings.—*London Mech. Mag., No.* 1413, *Sept.* 1, 1850.

Brown and Williams's Improvements in Electric and Magnetic Telegraphs, March 17, 1850.—The only new claim is a method of protecting the conducting wires of electric telegraphs by strands of hemp put on by a braiding engine, and then coating the whole by gutta percha. And a method of connecting the transmitting wires by screwing one end of a

: into a nut formed on the corresponding end of the next wire.—*d. Mech. Mag., March* 7, 1850.

V. S. Thomas's Improvements in Electric Telegraphs, patented Feb. 12, 0. *Claim.*—What I claim as new is, the making of signals or marks telegraphic purposes, by the agency of heat generated, induced, or trolled by a current of electricity passed along attenuated conductors, :s, or points; the signals being the flashes of light emitted by the :ed conductor or points, are manifest to the eye of the operator; the ks being produced on the paper by the heated point or conductor are record of the message.—*Journ. Frank. Inst., Sept.* 1850.

Ir. J. L. Palvermacher, C. E., of Vienna, Improvement in Galvanic teries, in Electric Telegraphs, and Electro-Magnetic and Magneto-Elec- Machines.—I only notice his improvements in electric telegraphs; is to say, in so far as regards, 1st, A method of varying the inten- of the current, either by increasing or diminishing the number of nents employed, or by interposing more or less powerful resistance to current. 2d, The imprinting letters or signs by one completion of current. 3d, The substitution of a letter cylinder for the letter wheel narily employed, and a method of arranging the letters and signs on cylinder. 4th, The application of a double escapement, each capa- of assuming four directions, and each producing effects different from e produced by the others. 5th, The employment of four electro-mag- , to act on two soft iron bars, and thereby render a weak galvanic ent, available in two directions, and productive of two separate and inct effects. And, 6th, The method of gradually detaching the keeper the electro-magnet, by causing the springs which act upon the per magnet, to come only successively into operation.—*Lond. Min. rn. Vol. XX, p.* 323, *July*, 1850.

Mitchell's Electric Telegraph.—At a recent meeting of the Philosophical iety of Glasgow, Alexander Mitchell, in a lecture on the electric tele- h, introduced some improvements stated to have been made by him he general arrangement of the instrument, in the use of only one wire, in the great facility by which the instruments can be worked. As n in a Glasgow paper, it appears that letters are arranged in a seg- t in front of the operator, and corresponding ones inscribing on keys ilar to those of a piano-forte. On pressing down a key, the corres- ding letter is immediately pointed to by a needle, a similar movement ng place at every station throughout the circuit. We know not if Mitchell was the first constructor of this kind of telegraph, but we know that a similar one was exhibited two years since at the Society Arts; and we also know that several inventors of telegraphs have been tent to use only one wire, employing the earth for the return circuit.—*d. Mining Journ. Vol. XX, April* 13th, 1850.

Justin F. Park's Improvements in Electric Telegraph Manipulators, y, New York, August 27, 1850.—"The nature of my invention con- s in arranging machinery for closing and breaking an electric telegraph uit in transmitting intelligence, whereby the operator, by giving a er key one instantaneous touch, as distinguished from the prolonged h applied to the key in ordinary machines, closes and breaks the

electric circuit, at and during such time as is required to signal or record a telegraphic sign for a letter, figure, or other character."—*Journ. Frank. Inst., Vol. XX, p.* 245.

The machine is stated to be ingenious, but unfortunately it is too complicated; the advantages of its use are to prevent mistakes from being made by telegraphic operators. I have not given the claims, as it could not be understood without a drawing.

Charles S. Bulkley's Improvements in Repeaters for Electro-Magnetic Telegraphs, Macon, Bibb Co., Georgia, Nov. 12, 1850: *Claim.*—"What I claim as my invention is, the manner of connecting two galvanic circuits with the two electro-magnets, (*a a*, and *d d*, in the said repeater,) each of the said galvanic circuits, as it passes through my said telegraphic repeater, embracing in its course the armature of the opposite electro magnet, in the said instrument, previous to its passing through the helices in the electro-magnet, embraced in its own respective circuit.

"In combination with the above, I also claim the connecting the points with the galvanic battery (or batteries), when the said points are placed in such positions in relation to the armatures of the electro-magnets in my said telegraphic repeater that when either one of the said electro-magnets is charged, it will, by attracting its armature against one of the points *l* or *i*, close the poles of the galvanic current in which the opposite electro-magnet (in the instrument) is in connexion, and thereby throw the battery into said circuit."—*Journ. Frankl. Inst., Vol. XXI, 3d series.*

The object of this repeater is for the purpose of repeating or recording a communication in several places at once along a line, and at the same time allowing the galvanic circuit to remain open when the line is not in use.

Siemens' Improvements in Electric Telegraphs.—Ernst Werner Siemens, of Berlin, patented in England, April 23, 1850, the following improvements: *Claims.*—"1st, The constructing electro-magnets for telegraphic purposes, of longitudinally divided tubes of iron or other magnetic metal, or of bundles of wire of iron or other magnetic metal.

"2d, The construction of instruments, for obtaining motion for telegraphic purposes, by means of one or two-electro magnets revolving on their axes within the fixed coils, by which they are rendered magnetic, or mounted on a transverse axis, and vibrating from side to side within the coils, by which they are magnetized.

"3d, The construction of instruments for producing motion for telegraphic purposes by means of metallic spiral coils or bands traversed by electric currents, and attracting or repelling each other; also producing motion in such spirals by the proximity of permanent magnets, which at the same time serve to produce electric currents by induction for working telegraphic apparatus.

"4th, The construction of the conducting contact pieces of alloys of platinum, iridium, or palladium with gold or silver, whether such alloys be further alloyed by the admixture of other metals or not.

"5th, The construction of electric telegraphic printing apparatus in such manner that the magnet which works the step by step motion, breaks and restores the circuit by the oscillation of the armature, or of the moving magnet itself.

"6th, The combining of electric telegraphic printing apparatus in the

me circuit with indicating apparatus, when the magnets which work e step by step motion of either or both instruments break and restore e circuit by the oscillation of the armatures, or of the magnets themlves.

"7th, The impression of the types on the paper at the instant that the pe-wheel stops, by arranging the electro-magnet which acts on the hamer, so that the short intermittent currents which work the electro-magnet the type-wheel traverses the coils of this magnet without producing otion of the armature, which, however, is set in motion when the curnt is rendered continuous by the stoppage of the type-wheel.

"8th, The arrangement of the magnet which acts on the hammer in ectro-telegraphic printing apparatus, so that its own circuit is broken by e magnet itself towards the end of its stroke.

"9th, The arrangement of apparatus in electric printing apparatus in ch manner that the printing is effected by pressing the type against iper, in contact with an inked roller.

"10th, An arrangement for retaining the moving piece which breaks d restores the electric circuit in its respective positions.

"11th, The application of a small pin for preventing the overrunning the ratchet-wheel in electric telegraphic apparatus, with the step by ep motion.

"12th, The arrangement of a transmitting apparatus with an indicating printing electric apparatus worked by step by step motion, or with both gether, in such manner that the transmitting apparatus breaks and reores the circuit of the telegraphic apparatus, which reciprocally breaks d restores the circuit of the transmitting instrument.

"13th, The combination of a self-acting alarum, with a transmitting paratus.

"14th, The combination of a self-acting alarum with a transmitting strument, which breaks and restores the circuit of the alarum magnet, iich in its turn reciprocally breaks and restores the circuit of the transitting instrument.

"15th, The combination of one or two cylinders carrying pins, with a ries of springs and keys, for making contacts for transmitting a distinct terminate succession of electric currents in one or both directions by e depression of each key.

"16th, The employment of an implement of the nature of a plough, d revolving cutters for making trenches or channels to receive underound line wires.

"17th, The application of the propelling power of a locomotive engine giving motion to such implements.

"18th, Conducting under-ground line wires into the ground, by means suitable guides, which either form part of, or immediately follow, the tting instruments.

"19th, The following improvement in the manufacture of coated wire electric telegraphic purposes: first, an arrangement of machinery for ating the wire, with two cylinders and pistons, by which the pressure the semi-fluid mass against the wire is equalized; 2d, arranging these linders, (or cylinder when only one is used,) so that they may be reoved and replaced by others, while the former are being discharged;

and 3d, the consolidating of gutta percha, or its compounds within thes cylinders in vacuo.

"20th, The testing of coated wire for telegraphic purposes, by passin it through water, with which is connected an apparatus capable of prc ducing electric shocks, so that the circuit may include the person of th operator, and may be completed by the passage of the electricity throug the defects in the coating in the wires.

"21st, The covering of insulated under-ground line wires with strip of sheet lead.

"22d, Establishing a direct communication between under-groun line wires and the earth, by means of a thin wire of German silver, c some other imperfectly conducting substance, so that the resistance to th passage of the electricity may be capable of being regulated at pleasure *London Mechanics' Magazine, No.* 1421, *Nov.* 2, 1850.

An interesting report of M. Siemens' telegraph to the Academy of Science, Paris, will be found in VOL. XXI, Third Series, of this Journal, p. 209 and 255-15, 1850.

The commission conclude their report of M. Siemens' apparatus in the following words: "The commission have examined M. Siemens' apparatus with great interest, and remarked throughout, an evidence of a perfect intelligence of the theory, as M. Siemens appears to have taken into account all the complicated phenomena which are manifested in the conductors and electro-magnets, especially when the actions are of short duration.

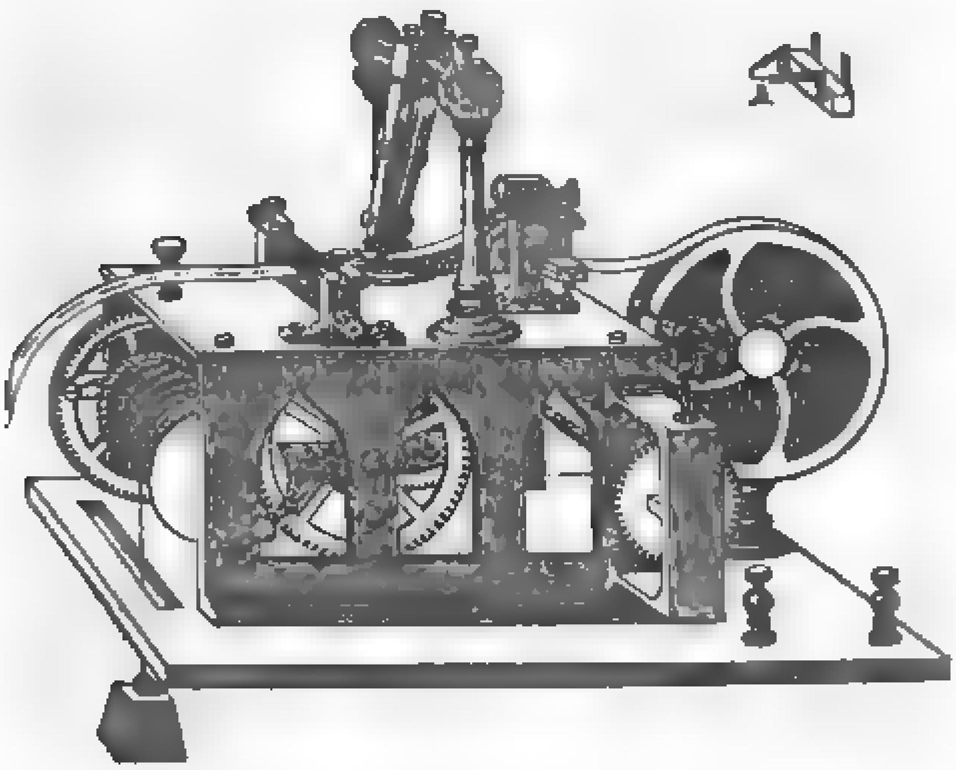
M. Siemens' system, if worked with care and attention, appears to possess incontestible superiority over all other apparatus of the like nature, that is to say, the ordinary arrangement of alphabetic apparatus; as the latter do not work with the same degree of precision and accuracy. With regard to speed, the commission are led to believe that M. Siemens' apparatus surpasses all other alphabetic apparatus; their opinion is, also, that M. Siemens' improvements in the construction of electro-magnet will prove advantageous.

Horn's Igniting Telegraph, patented June 25, 1850.—The register invented by G. H. Horn, of Boston, employs a principle, namely, the heating o igniting effect of electricity. When an electrical current flows through a fine platinum wire it ignites it, or brings it to a red heat. If this wire is bent, as at A, in figure 55, so as to be in contact, for a short distance, with a moving fillet of paper, it will burn a hole through the paper when the current passes. This can be done with great rapidity, so as to represent probably a hundred linear letters per minute.

This instrument, the greater part of which consists of the clock-work, spool, &c., required for moving the paper. Above the clock-work are two pillars, supporting an axis, upon which is the adjustable wire-holder, the lower extremity of which is seen touching the fillet of paper. By means of the connexions and insulations of the pillars, axis, and wire-holder, the platinum wire, which passes over a little slip of porcelain at the end of the wire-holder, becomes part of the circuit, with which the two screw-cups on the right of the base-board are connected. When the wire needs adjustment, the wire-holder can be turned up on its axis

bed supporting the fillet of paper is also adjustable, so as to regulate contact between the wire and the paper.

Fig. 55.



his register requires a quantity current to produce the effect of igni- and therefore needs a receiving instrument and local battery, to be ated by the telegraphic circuit.—*Book of the Telegraph, p.* 37.

his telegraph is the same in principle with that patented by Wm. S. mas, Feb. 13, 1850.

efore concluding these lectures I will here notice two telegraphs h I have omitted in their regular order, and first of

he Telegraph of Brett and Little of London.—The magnet employed is telegraph is in the form of a ring or horse-shoe, and is suspended e centre of helices of copper wire, which are double and of a cir- form. This magnet is deflected either to the right hand or to the according to the direction of the current. The indicators are not nets, but are moved by the agency of the magnets, by which a dis- and certain indication is insured.

nother modification of this instrument has been made by Mr. Little, h is as follows: the patent instrument is of the form of a disk of ma- ny, about 1 foot high by 8 inches broad, standing in a vertical position pedestal; the only appliances at the back being the metallic buttons, nding screws, necessary to convey the galvanic fluid from the bat- to the indicators. Two tubes of glass about one-fourth of an inch ameter, and 3 inches high, are placed in front of the disk, with the abet engraved on a metallic plate placed between them, with the ber of deflexions required to express each letter, stated in plain es. On the top of each of these tubes, which contain spirits of , is a small but powerful cylindrical magnet about one-fourth of an in diameter, from the bottom of which are suspended by magnetic ction, two needles with the points upwards.

n completing the galvanic circuit, these needles are deflected with t rapidity with one on an axis; and on breaking connexion, the needle

is instantly arrested in its fall to the perpendicular by the density of the fluid, with almost as dead a stop as the seconds hand of a watch, avoiding the vibration so annoying in the old system, which tends so much to puzzle and mislead.—*Lond. Mining Journ., Vol. XXI, p.* 183.

Bakewell's Electric Telegraph.—This is a modification of the instrument of Alex. Bain, Esq., noticed under the head of Electro-chemical Telegraphs, employing the same chemical agent, but instead of holes cut in paper, the message to be sent is written on a sheet of tin foil with sealing wax varnish; this is placed on the transmitting cylinder; all the lines of the non-conducting varnish serving to break the connexion. On the receiving cylinder, a sheet of paper moistened with acidulated ferro prussiate of potash is placed. When the connexion is completed, electro-chemical decomposition is effected; and where any interruption occurs, no change takes place.

For the Journal of the Franklin Institute.

On the Steamboats of the Western Waters of the United States. *By* J. V. Merrick.

In another part of this number will be found a table extracted from the report of proceedings in the Wheeling Bridge Case, containing (what are believed to be) reliable data respecting some of the steamboats now running on the Ohio and Mississippi rivers. An examination of some of the details of this table will show conclusively a very curious fact respecting the practice of Western engineers, which, although it may before have been noticed, has been hitherto overlooked, or ignored in the construction of their machinery.

The Western steamboats are made on a peculiar type, which is to be found principally in that section of the country, and whose existence at this stage of improvement in river navigation only serves to show how far prejudice, and a spirit of servile imitation, can prevent advances dictated by science, or by successful experience elsewhere. They are, with but trifling exceptions, propelled by a pair of high pressure inclined engines, bolted to timber frames, and with very long wooden connecting rods; each engine being attached independently to its own wheel. They are placed on deck, (which is within two or three feet of the surface of the water,) and with the boilers occupy from one-third to one-half the length of the boat, and the whole breadth inside the wheel-houses. The valves are of the description known as "poppet," which till within a very recent period were made single, and required considerable power to work them, but are "double" (or balanced) on the new engines. Steam and exhaust valves are worked by separate cams attached to their respective rock-shafts; provision is made for connecting these shafts when it is desired to work full stroke, but the cut-off is not adjustable. Each valve is lifted by a lever, in the usual "safety valve" style, which lever stands parallel to the cylinder, and covers the tappets on the rock-shafts; the latter, of course, crossing the cylinder near the middle of its length. The valves are not allowed to lift high enough to give an area of passage equal to their own, which in itself is usually smaller than given by the usual English and our own Eastern practice.

The boilers are cylindrical, with two flues; are set in brick work, and

placed upon the deck forward of the engines; furnaces forward; and the flame, &c., passing under the shells to the after end, returns through the flues. It is the universal custom to carry steam of a very high pressure in the boilers, a circumstance which has now become a sort of proverb, and the results of which, combined occasionally with those of an opposite error in respect to the water level, may be found in the records of steamboat disasters in the United States, and present a lamentable instance of reckless disregard for the safety of human life.

The object of the present article is to show that this high pressure, with all its attending evils, is entirely unnecessary; and it is to this "curious fact," before adverted to, that it is now desired to call attention.

The application of an indicator to any of these engines would demonstrate this point; but as such attachment has not been made, so far at least as I am aware, recourse must be had to another method of proof.

The economical efficiency of a boiler depends on the relative proportions of its effective heating surface, grate surface, and least cross section of flues or chimney, and the rapidity of combustion, or consumption of fuel. The greater the rapidity with which combustion is carried on, the less perfect is it, and hence the less economical will it be. Hence, (within certain limits,) that boiler which burns least fuel *per square foot of grate*, in a given time, or, in other words, which has a larger grate to burn the same fuel, evaporates the greatest amount of water by the combustion of a pound of fuel. That boiler which presents the greatest extent of effective heating surface to the action of the combustible, will, of course, draw from it the greatest useful effect with a given velocity of draft. Finally, the less the velocity of draft requisite, the greater useful effect will be obtained, since the products of combustion have more time to communicate their heat.

To compare, then, the circumstances attending the consumption of fuel with those of other instances, I shall take an average of five western packets, (in order to obtain a mean result,) and compare it with some steamer whose consumption per square foot of grate is about the same as theirs.

On referring to Bartol's *Marine Boilers*, we find that the steamer *Mayflower*, running on Lake Erie, consumes 6160 pounds of bituminous coal per hour, on a grate of 151 square feet, or 40·8 pounds per square foot per hour; total heating surface, 4791 square feet, or ·778 feet of surface per pound of coal per hour; useful effect produced, 5·94 pounds of water per pound of coal.*

In the five packets before alluded to, and which are hereafter specified by name, the average consumption of fuel is 3254 pounds of bituminous coal or its equivalent per hour, on a grate of an average area of 79·2 sq. feet, or 40·87 pounds per square foot per hour; total heating surface averages 1940 square feet, or ·596 feet of surface per pound of fuel per hour; being but ·766 that of the *Mayflower*.

The velocity of draft under these circumstances, since the same quantity of coal is burned per square foot of grate, would depend on the rela-

* The author states it at 6·3 pounds, but informs us at the end of the work, that this is based on the supposition that there is no difference between boiler and cylinder pressure; assuming this at 2 pounds, which may be called a minimum, 5·94 is the real coefficient.

tion between the respective areas of flue and grate. In the five packets it is as follows:—

	Consumption of bituminous coal per hour pr. sq. ft. grate.	Ratios of areas of grate to flues.
Clipper, No. 2,	43·00	1 to ·1250
Hibernia, No. 2,	37·37	1 to ·1336
Bostona,	39·06	1 to ·1780
Buckeye State,	49·72	1 to ·1830
Messenger, No. 2,	35·22	1 to ·1654
Mean,	40·87	1 to ·1570

Or an average ratio of 1 to ·1570, while in the *Mayflower* it is 1 to ·1780; whence it follows that to allow the same amount of air, &c., to pass, the velocity required in the western boats must be to that in the boiler of the *Mayflower* as 1·134 to 1·000, and hence that in the latter case more useful effect would probably be obtained from the fuel.

Finally, the boiler of the *Mayflower* is a single "rising flue," while those of the western boats are cylindrical, and it is known that in the latter form, the proportion of *effective* in the total heating surface is less than in the former. Since, then, all the circumstances are concurrent to more perfect combustion in the boiler of the *Mayflower*, and since in that case the useful effect is as 5·94 to 1, it appears that from 4½ to 5½, to 1 will be a fair allowance as a *maximum* effect in the western boats. In order to allow for the difference in temperature of the water entering the boilers, and to insure a perfectly fair comparison, I shall employ in it the higher number or 5·5 pounds of water to a pound of fuel, as the maximum useful effect.

Having determined this point, it remains to show that with this *maximum* of evaporation, it is impossible to produce a volume of steam sufficient to fill the cylinders, at their point of cutting off, and number of revolutions per minute, with steam of any thing like the pressure carried in the boilers.

Referring to the table, we obtain the following calculation, which is tabulated for comparison:

	Names of Packets.	Space displ'nt of piston for each double stroke at point of cutting off.	Revolutions per minute.	Consequent volume of steam used per minute.	Consumption of fuel per minute.	Calculated vol. water evap. at the abv. stand'rd	Ratio vol. steam to vol. water.
1	Clipper, No. 2,	58·61 cu. feet.	22	1289 cu. feet.	42·42 lbs.	3·633 cu ft.	342
2	Hibernia, No. 2,	91·66 "	19	1742 "	49·81 "	4·785 "	394
3	Bostona,	77·66 "	20	1553 "	52·09 "	4·583 "	339
4	Buckeye State,	91·66 "	18	1650 "	71·35 "	6·279 "	261
5	Messenger, No. 2,	78·59 "	19	1493 "	50·53 "	5·362 "	276
			Average,	1545 "	53.24 "	4·928 "	322·4

Giving as an average result, a volume whose corresponding pressure is 74·7 pounds above the atmosphere; while that carried in the boilers was respectively 150, 150, 145, 140, and 150; average, 147 pounds; difference between boiler pressure and maximum average cylinder pressure, 72·3 pounds.

I am not to be understood as saying that the pressure never exceeds this point; far from it; it is very possible that at the commencement of a stroke, or at some point in it, it may be higher: but simply, that the *average* pressure during the time for the admission of steam, cannot differ greatly from the one named.

It may be very true, that the consumption of fuel is, of all other data respecting the performance of an engine and boilers, the least reliable; since different firing, different qualities of coal, and differently arranged boiler surface, &c., may modify the useful effect within wide limits: but when it is considered that on the one hand, the Mayflower is a boat (running on Lake Erie) burning the same quality of fuel as the Western boats; that her consumption is the average of her running trips; that it was certainly not to the interest of the reporter to magnify that consumption, when it was known that the report was intended for publication; and, on the other hand, that an average of *five* packets, running on different routes, and supposed to have all the modern improvements, &c., was taken with an average of their running consumption through the whole trip; that it was certainly not to the interest of those reporting their performance, to name a *less* amount of fuel than the true consumption, (since, other things being the same, a diminished consumption would require a diminished height of chimney,) it is certainly, in view of these points, not possible to conceive that the maximum pressure in the cylinders as calculated can vary greatly from that actually maintained.

It will be observed that the least volume in the table just given (that of No. 4) gives a pressure of 96·6 pounds above the atmosphere; while the greatest volume (that of No. 2) gives a pressure of 58 pounds; mean, 77·3;

Why then, it will be asked, is this tremendous pressure carried, if so useless in propulsion? Among other reasons may be named; 1st, Custom and prejudice, which on the Western waters require a high pressure of steam to be maintained; otherwise the boat is not considered either fast or powerful. 2d, The absurd notion existing among a large class of their engineers, that steam has a momentum or impact, which at high pressures imparts a force to the piston over and above that due to its pressure, when considered as a compressed and elastic vapor. 3d, and most probably the principal reason; a contraction in the steam openings and pipes, which increases the friction due to the passage of steam at such high pressure, and diminishes the velocity at which it can be supplied to the cylinders, thus rendering necessary a great difference between the boiler and cylinder pressure.

If these reasons are just, the remedies are quite as plain, and need not be enlarged upon. It is easy to increase the area of passages, and insure a liberal supply of steam to the cylinders, even though such augmentation be attended with increased expense; and expense should be no object when viewed as a certain means of obviating the *necessity* for carrying this dangerous pressure of steam. Then legislative enactment must lend its aid to compel engineers to work their boilers at the minimum pressure, which, with wide throttles, will be found as efficient as the present system.

There is, therefore, no doubt that a much lower pressure of steam might with the same engines *perform* all that is done by the exalted pressure, *now carried so universally;* while at the same time the comfort,

economy, and, above all, the safety of the boats, would be vastly increased.

But there is another means of overcoming the difficulty, and of increasing the economy of these packets, viz: the employment of condensing engines, which would at once cut down the requisite initial pressure 12 to 14 pounds per square inch, and by lessening the work of the boilers, permit a more perfect combustion of fuel. And although prejudice has done its utmost to prevent, or rather to postpone, in that section of the country, this improvement, high pressure engines will as certainly be driven from the Western rivers, at some future day, as they have been from the Lakes within the past few years. Their use on Lake Erie, which was formerly the *rule*, forms now a bare exception.

For the Journal of the Franklin Institute.

On Marine Propulsion. Reply to J. V. MERRICK, Esq. *By* J. W. NYSTROM.

Mr. Merrick's "*clear case*" resembles so much the turbid water of a swollen stream, that we think it must pass through the filterer of criticism, taking for our compound the *Static* and *Dynamic momentum.*

The first point to be tested will be found on page 271. In the first paragraph, Mr. M. states that if the above is not "clear enough he will state it in another form." *No, it is not clear.*

Let the arrows m, n, o, figs. 1 and 2, plate V, represent the direction of motion of the centre of the paddle wheels on a steam vessel, w, w, w, being the load line and water in which the paddles act.

The accompanying diagram plate V, represents two different situations of the vessel. Fig. 1, the paddles take hold of a rock in the water, so that the vessel can move freely without touching the rock; then there will be no slip of the paddles, while the vessel moves the space H. Fig. 2. The paddle acts freely in the water, so that while the vessel moves the space H, the paddle moves backwards the space V, which then will be the slip. Suppose the vessel moves the same space H in a unit of time; then if slip causes a loss of effect, more power should be required in fig. 2 than in fig. 1.

First Case, Fig. 1.—The crank of the steam engine is supposed to be in the same line as the acting paddle; then the line $R + r$ will be a lever of the second kind, with its fulcrum against the rock at c. The letters will denote:—

r = radius of the crank.
h = pressure in the crank pin.
b = velocity of the crank pin.
R = radius of the paddle wheel.
B = resistance in the centre line of the paddles.
H = velocity of the vessel.
c = resistance against the rock.

$$\text{Static momentum,} \quad \left\{ \begin{array}{l} \text{Action } (h + c = \text{B reaction.} \\ \text{B} : h = (\text{R} + r) : \text{R.} \end{array} \right.$$

$$\text{Dynamic momentum,} \quad \left\{ \begin{array}{l} b : \text{H} = (\text{R} + r) : \text{R.} \\ \text{B} : h = b : h. \\ \text{Action } hb = \text{BH reaction.} \end{array} \right.$$

Second Case, Fig. 2.—The crank pin moves the space W while the paddle moves the space V. There will be found a point, c, on the paddle arm which has no motion, and is therefore a fulcrum thereof.

I = pressure in the crank pin.
W = velocity of the crank pin.
B = resistance in the paddle journal.
H = velocity of the vessel or journal.
M = resistance of the water.
V = velocity of M.
c = resistance in the fulcrum c; and

$$\mathrm{I} + c = \mathrm{B} \quad \text{of which} \quad \mathrm{B} = \mathrm{I} + c. \qquad (1.)$$

$$\mathrm{I} : c = \mathrm{S} : r \quad \text{``} \quad \mathrm{S} = \frac{\mathrm{I}\,r}{c}. \qquad (2.)$$

$$\mathrm{V} : \mathrm{W} = s : (\mathrm{S}+r) \text{``} \quad s = \frac{\mathrm{V}(\mathrm{S}+r)}{\mathrm{W}}. \qquad (3.)$$

$$s\mathrm{M} + \mathrm{BS} = \mathrm{I}(\mathrm{S}+r) \quad \text{``} \quad s\mathrm{M} = \mathrm{I}(\mathrm{S}+r) - \mathrm{BS}. \qquad (4.)$$

By the insertion of the formula (3) in (4), we obtain—

$$\mathrm{M}\frac{\mathrm{V}(\mathrm{S}+r)}{\mathrm{W}} = \mathrm{I}(\mathrm{S}+r) - \mathrm{B\,S}.$$

$$\mathrm{M\,V} = \frac{\mathrm{I}(\mathrm{S}+r) - \mathrm{BS}}{\frac{(\mathrm{S}+r)}{\mathrm{W}}} = \frac{\mathrm{IW}(\mathrm{S}+r) - \mathrm{WBS}}{\mathrm{S}+r} = \mathrm{I\,W} - \frac{\mathrm{W\,B\,S}}{\mathrm{S}+r}. \qquad (5.)$$

By the insertion of the formulæ (1) and (2) in (5), we obtain—

$$\mathrm{M\,V} = \mathrm{I\,W} - \frac{\mathrm{W\,I}\,r(\mathrm{I}+c)}{\left(\frac{\mathrm{I}r}{c}+r\right)c} = \mathrm{I\,W} - \frac{\mathrm{W\,I}\,r(\mathrm{I}+c)}{\mathrm{I}r+cr} = \mathrm{I\,W} - \mathrm{I\,W}\frac{r(\mathrm{I}+c)}{r(\mathrm{I}+c)}$$

that is to say, M V = I W—I W = 0. Or, M V is no part of I W.

We see now that M V is of no effect at all for propelling the vessel; it only serves to keep the paddle arm stationary at the fulcrum c, and if we examine M V without any theory, we will find that the resistance M acts *with* the vessel, but the velocity V acts *opposite* the same, and they thereby counterbalance each other, and produce *no* effect for propelling the vessel.

Let the velocity of the paddle at the circumference be J, and V a fraction thereof. The effect exerted in the water should be M J V; but if we carry M J V to the fulcrum it will be equal to 0, because V = 0, and there it will act as a resistance in marine propulsion, as the rock in fig. 1, with no effect. Then we have another lever of the second kind, with its fulcrum in c, which we will compare with the first case, fig. 1.

Fig. 2:—

$$\text{Static momentum,} \quad \left\{ \begin{array}{l} \text{Action } \mathrm{I} + c = \mathrm{B} \text{ reaction.} \\ \mathrm{B} : \mathrm{I} = (\mathrm{S}+r) : \mathrm{S}. \end{array} \right.$$

$$\text{Dynamic momentum,} \quad \left\{ \begin{array}{l} \mathrm{W} : \mathrm{H} = (\mathrm{S}+r) : \mathrm{S}. \\ \mathrm{B} : \mathrm{I} = \mathrm{W} : \mathrm{H}. \\ \text{Action } \mathrm{I\,W} = \mathrm{B\,H} \text{ reaction.} \end{array} \right.$$

But $\mathrm{B\,H} = hb$.

Therefore $\mathrm{I\,W} = hb = \mathrm{B\,H}$ which was to be proved.

We see *now that the effect given* in both fig. 1 and fig. 2 is equal,

and what the velocity in the one case is greater than in the other, the pressure will be so much less, because it acts on a shorter lever. To compare this with screw propellers, let the letters represent—

R=P pitch of the propeller.

S=(P —*s*) as in the paddle wheel.

Then we have $W : b = S : P$.

With equal velocity of the vessel, the different values of the pressure W is measured by S=(1 —*s*,) and caused by different areas of propellers. (See further respecting acting area of propellers.)

The appearance of loss of effect by slip is measured by the mass of water forced backwards;—it can be viewed in another way. Suppose a vessel runs in a canal say 1000 feet long, and has a sectional area equal to 10 of the propeller, whose pitch is 10 feet; then, when the propeller has made 100 revolutions, the vessel should run the 1000 feet if there was no slip. But suppose the slip to be 50 per cent.; then when the vessel reaches the other end of the canal, the propeller will have made 200 revolutions: that is, 100 revolutions which have propelled the water backwards; consequently, at the other end of the canal there should be no water left for the vessel to float in. But it will be found that when the vessel has passed the 1000 feet, the water is at the same height as when the vessel started from the first end. So it will be with a vessel starting from Liverpool for New York,—on reaching New York, the water will not be higher in Liverpool or lower in New York, extracting the tide. At the moment that a vessel starts, the slip is equal to the unit; if it is a measure of loss of effect, the vessel could never be started.

Mr. M. says, "And then the ratio of the coefficient * * * to the velocity of the water backward." Now, after Mr. M.'s lengthy disquisition, "that slip is no loss of effect," he comes to the conclusion of my first formula: $p\,v = r\,s$, or, as Mr. M. expresses it, $p : r = s : v$, in which

p = coefficient of the vessel.

r = area of floats multiplied by the coefficient for resistance to plane surfaces.

v = velocity of the vessel.

s = velocity of the water backwards (slip).

This is a proof that slip is *no* loss of effect. The effect delivered from the steam engine $r\,s = p\,v$ the useful effect.

After Mr. M. has embodied the formula, he condemns it as wrong, and says it should be $p = r$.

If Mr. M. had substituted *resistance* of the vessel instead of *coefficient*, it would have been all right. But this "coefficient" makes the remainder of his article wrong.

In his note Mr. M. says, "By the coefficient of a vessel, I mean that, * * * or 1 nearly." Here Mr. M. is confused in the difference between effect and pressure. When a body, P, is to be moved from its passive state, and has no other resistance than its own inertia, the *pressure*, B, which is required to give that body a certain velocity, V, in a given time, T, is

$$B = \frac{P\,V}{g\,T}. \qquad (1.)$$

But the power which is required to give the same body the same velocity in the same time, is

$$BH = \frac{PV^2}{gT}. \quad . \quad . \quad . \quad . \quad . \quad (2.)$$

D = total distance which the body has moved in the time T, and

$$\text{Pressure } B = \frac{2PD}{gT^2}. \quad . \quad . \quad . \quad . \quad (3.)$$

$$\text{Effect } BH = \frac{2PD}{T}. \quad . \quad . \quad . \quad . \quad (4.)$$

To apply this to vessels, we must first suppose the vessel P to have no other resistance against B H but its own inertia; then B H would give the vessel P the velocity V in the time T, and if at the end of the time T the pressure B be taken away, the vessel would still continue with the velocity V until some resistance acts opposite her direction; but as a vessel has the additional resistance of the *water* to sustain, the effect B H will not be sufficient to give the vessel the velocity V in the time T; we therefore will find another value of B H. The letters will denote—

R = resistance of the water at the velocity V.

r = mean resistance of the water in the time T.

The effect which is required to the resistance of the water in the time T will be—

$$\text{Effect} = \frac{rD}{T} \quad . \quad . \quad . \quad . \quad . \quad (5.)$$

This must be added to the formula (4), so that

$$BH = \frac{2PD}{T} + \frac{rD}{T} = \frac{D(2P+r)}{T}. \quad . \quad . \quad (6.)$$

We see here that even in the time T the effect B H is, independent of $g = 32{\cdot}08$.

The time will be $T = \dfrac{D(2P+r)}{BH}$.

At the end of this time T, the vessel has obtained the velocity = V, the resistance of the water = R, and the equation (4) will be = 0. Then the effect which is required to keep the vessel at the velocity V will consequently be B H = R V.

We see now that the effect which propels a vessel, a uniform velocity is entirely independent of the moving mass P, and the acceleratrix g, and that the resistance R, depends on the greatest section area of the displacement, friction area, and form of the hull. The square of the velocity multiplied "by the cubic feet of water" in motion, is a measure of the effect which has given the mass of water that motion, and *not* a measure of number of pounds.

Mr. M. says: "But the projecting area acting * * * multiplied by the secant, * * * is the advance of the vessel during a revolution."

It is well known that resistance to planes in motion in fluid, can be less by moving the plane at some angle, more or less than 90° to the direction line; but I did not know that it could be greater than itself, as will be the case when multiplied by a secant, which is always greater than one. The area Mr. M. multiplies, can be increased and diminished *ad libitum*, in the *same diameter of* propeller. But when Mr. M. finds his *secant, he adds two squares together* and divides the sum by a square;

he calls that a secant $=1\cdot40$; that must be a secant $=1\cdot40$ *square radius*;—then I suppose the corresponding angle will be *square degrees!* But if Mr. M. extracts the square root of his equation, he will obtain a true secant for the angle described, but then it will be my formula *turned upside down*, which makes it all wrong. It is the formula Mr. M. has condemned, and entitled "empirical."

The area Mr. M. calls 108 square feet, is only 65, and multiplied by the secant, it will be about 91 square feet.

Further, Mr. M. says, "the pressure constantly exerted by * * is entirely independent of the velocity by which the vessel moves,"—a given pressure in the steam cylinder can produce different velocities of the vessel! On which side of the equation does Mr. M. carry the circumstances? Next, as regards the acting area of the propeller, he says, "It appears to me, however, to be neither of these; but the projected area by the ratio of length between the helicoidal path traversed by the centre of effort, &c.;" if we apply this to our proposed test, it will come out, the more pitch in proportion to the diameter, the greater the acting area of the propeller should be.

This is entirely opposite to the fact. It is a fact that, propellers with more pitch and slip, employ the effect better for propelling, (if they do not exceed $n=\frac{200}{\text{P S}}\sqrt{\text{D}}$ revolutions per minute,) but there is another reason, namely: *that a less acting area has a greater velocity, and that the resistance to the same is in proportion as the square of its velocity, and that the friction in the water is in proportion as the acting area.*

I will here add a formula on which this acting area should depend. Letters denote—

A = acting area of the propeller.		(less than $0\cdot785\ \text{D}^2$.)
D = diameter	" "	(extreme.)
P = pitch	" "	
C = circumference	"	(at the diam. D.)

$$\text{A}=\frac{2\cdot5\ \text{D}^3}{\sqrt{\text{P}^2+\text{C}^2}}$$

This formula forms a part of the one given for finding the slip. The divisor $\sqrt{\text{P}^2+\text{C}^2}$ is a secant for an angle whose tang. $=$ P and radii $=$ C. When I can, I rather avoid trigonometrical expressions, but *simply* this will be, *multiply* the area of the propeller by the *sine* for the angle of the propeller blades to the axis at the periphery; the product should be the acting area.

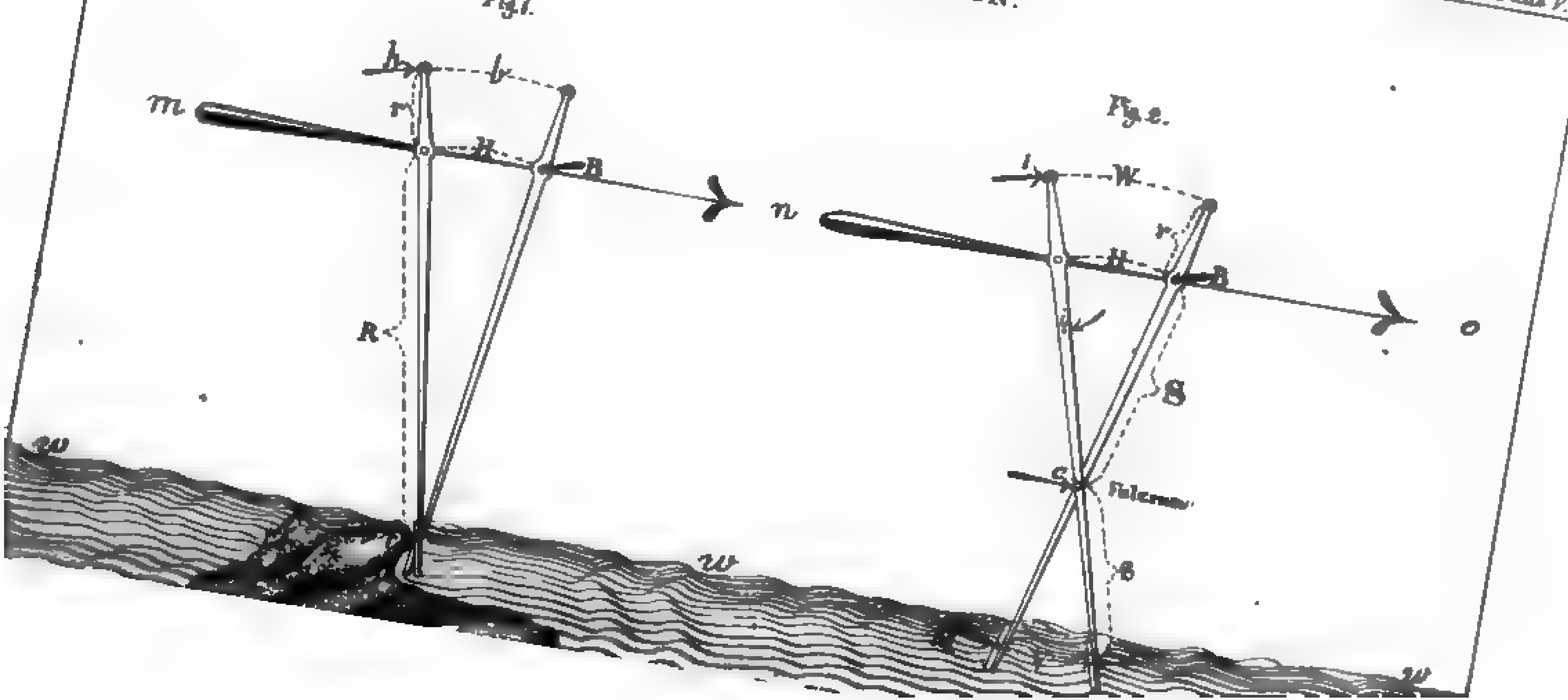
Mr. M.'s theory is, *divide* the projecting area of the propeller blades by the *sine* for the same angle, when the pitch is the advance of the vessel during one revolution, the quotient should be the acting area of the propeller; expressed in a formula without trigonometry, it will be—

$$\text{A}=\frac{\text{D}\,Lm\sqrt{\text{P}^2\,(1-s)^2+\text{C}^2}}{4\,\text{P}.}$$

C = a circumference taken at the centre of effort of the blades.
L = *length* of the propeller.
m = *number* of blades.
s = *slip in a decimal fraction.*

Vol. XXIII 3rd Series. Plate V.

MARINE PROPULSION.



These four quantities have certainly something to do with the acting ea, but they are not at all a measure of the same; they can vary conlerably with the same acting area. But, the projecting area of the linder described by the propeller, multiplied or divided by some coeffint can not vary at such ad libitum. It appears to me, Mr. M. has misken the propeller for a paddle wheel, where his rules would be more ely to be applicable.

Mr. M.'s remarks about "action and reaction," I will not contradict, as nay be somewhat mistaken in the expression; but I will here explain w I understand it: action and reaction = pressure and resistance *in tics.* But in *dynamics* action and reaction = power.

When Mr. M. finishes his theory, he says: "such are the indications theory, but it is found that the values given by them are but approxiite." How is it possible that a theory composed of such incongruities er can reach approximation? It is often the case that such a theory is plied in practice, and gives a wrong result, *then theory in general* is med. However, Mr. M.'s theory will surely do no harm in practice, cause it is applicable *first*, when the work is finished. "And that there some modifying circumstances experienced in practice." We cant expect a result to come out nearer than the circumstances are carried, d Mr. M. says himself that "circumstances are generally on one side of e question."

After Mr. M. has repeated my statements based on Mr. Isherwood's ror, he says: "The whole structure of the argument is built upon sand." s, *sir*, but I am not the builder; Mr. Isherwood first designed it, and plied it to the *San Jacinto*, and I made remarks upon it, stating it to be ong, &c., &c.

But after all, I cannot find where Mr. M. proved my misapprehension the first principles of dynamics; he says that the first equation "should ve been $p = r$; consequently the results attained by it are valueless;" it is no proof at all, to say this is wrong; "consequently," *not right.*

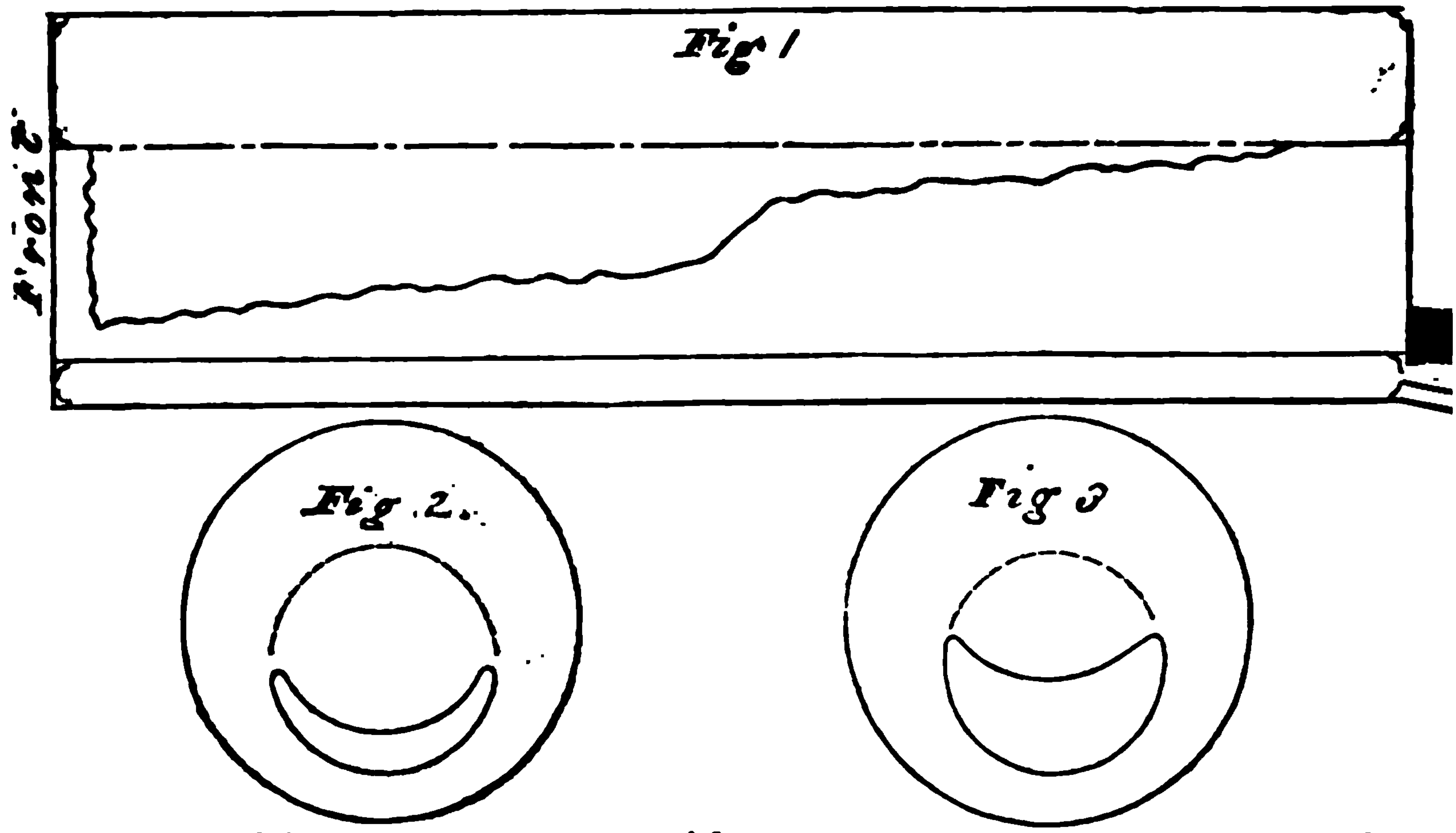
For the Journal of the Franklin Institute.

Steam Boiler Explosion in New York.

One of the boilers of the extensive sugar refinery of Messrs. Howell, ig & Co., Duane street, New York, exploded early in the morning of 12th of April, at the moment of starting the engine. There are four lers in the set, each 6 feet in diameter, 40 feet long, with one flue 42 hes diameter; thickness of iron used in the shell, $\frac{5}{16}$-inch, and in flue, ich. The furnace is within the flue, at the front end. This form of er is the kind generally used with Cornish engines, and is capable of sting a heavy pressure of steam.

n the present case, it will observed by fig. 1, which gives a longitudisection of the boiler, that the top of the flue, at the front end, has been from the head of the boiler, and crushed nearly to the bottom. At back head no fracture is visible, but there is evidence of severe n. Fig. 2 is a cross section of the boilers at the front; and fig. 3 a

section at the centre; both showing the shape of the flue after the accident. The dotted lines in all three figures show the original form of the flue.



As is usual in such cases, the evidence before the Coroner's Jury (five men were severely injured, three of whom soon after died,) was very conflicting, so far as opinions went; but the following facts were elicited:

The engineer did not know the state of water, and could not tell any thing about it. The boilers were independent of each other, each having a safety valve, and also a screw valve, for shutting off or connecting with the other boilers. It is also stated, that baked molasses and bone-black were found around the safety valve after the explosion; and that the screw valve, which admitted the steam from this boiler into the common steam pipe, was found shut.

If we suppose the boiler to have had its full supply of water, and that the explosion was the result of an excess of steam, caused by the safety and screw valves being shut, we have three things to account for.

1st, Why did this one boiler generate such an excess of steam, while the other three in the same time had reached a pressure of but 35 pounds?

2d, The explosion took place at the starting of the engine, which, in the absence of positive testimony to the contrary, is considered good evidence of a short supply of water. 3d, The greatest depression in the flue, and the only fracture, is over the furnace, where there would be the least strength in case of low water.

If, on the other hand, we suppose the water to have been low in this boiler, as was thought by some of the witnesses, who judged from the appearance of the iron after the accident, then it would have generated a higher pressure of steam in the same time than the other boilers; and if we still further suppose that the screw valve of this boiler was not fully shut, (no reason was given for this valve being closed,) but that it would allow the passage of a small quantity of steam, then the starting of the engine would cause the water to rise over the heated surface of the flue, and the explosion follow in the usual way. The explosion may be explained by either mode, and as positive evidence is very limited, we may be at liberty to take either side of the question. H.

*Cornish Engines.**

ie number of pumping engines reported for Dec., 1851, is 20. They consumed 1542 tons of coal; and lifted 13,000,000 tons of water thoms high. The average duty of the whole is, therefore, 50,000,-.bs. lifted one foot high by the consumption of a bushel of coal hing 94 lbs.—*Lean's Engine Reporter, Jan.* 5, 1852.

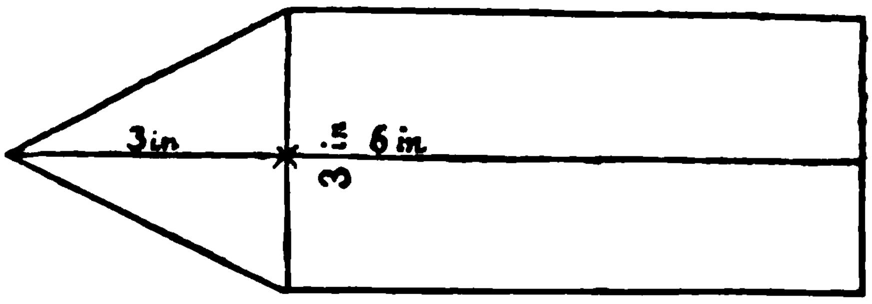
---

on the Principles which should regulate the Forms of Boats and Ships, rived from original Experiments. By Mr. William Bland, *of Sitgbourne, Kent.*†

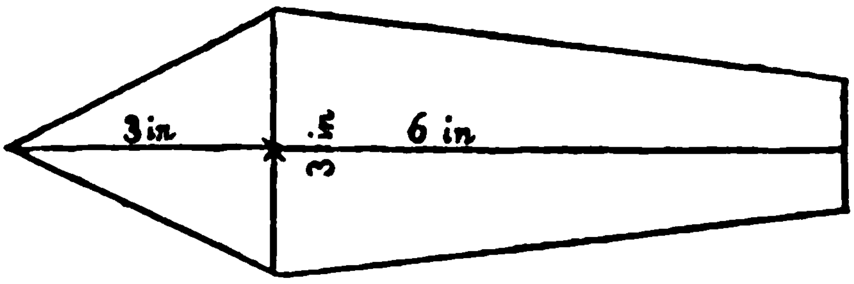
Continued from page 194.

Chapter VI.—Experiments relating to the Stern.

cperiment 17.—First, with the sides parallel and tapered. Two mo-having the same form of bow, an isosceles triangle of 3 inches per-icular distance from the base, and 3 inches wide; with the bodies hed 6 inches long; one of them with parallel sides, the other tapered iown in the diagram; scale, ¼-inch to one inch.



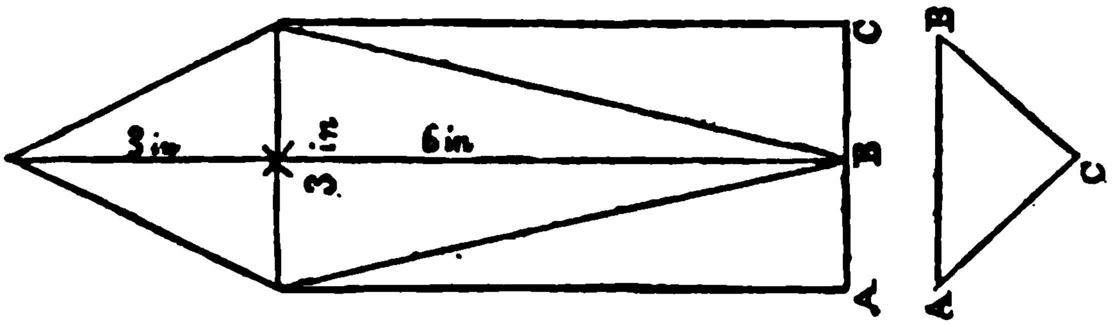
No. 1.—Weight 10 oz.; thickness 1½ inch.



No. 2.—Weight 10 oz.; thickness 1½ inch.

pon being tested against each other, there appeared a slight degree ieed in favor of the parallel-sided model (No. 1), and decidedly er stability than was possessed by the tapering-sided model (No. 2).

cperiment 18.—A third model (No. 3) of the same bows, length, ı, and weight, was tested against No. 1; but having its sides beveled rds and at the stern.

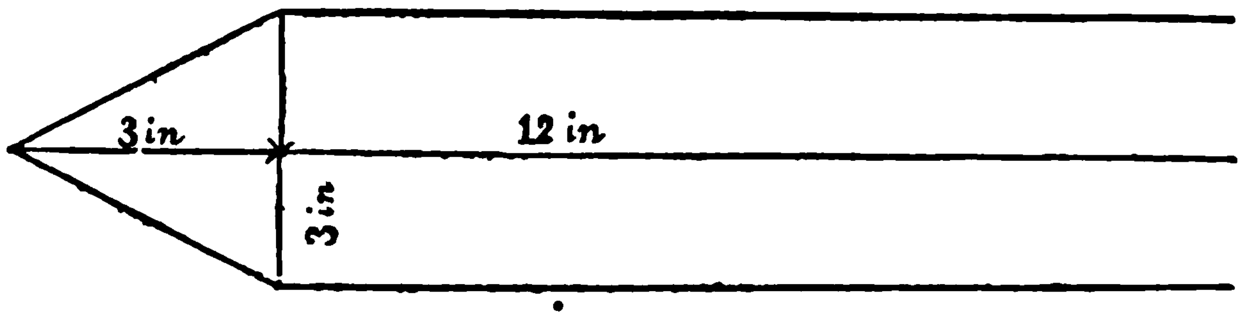


No. 3.—Weight 10 oz.; thickness 1½ inch.

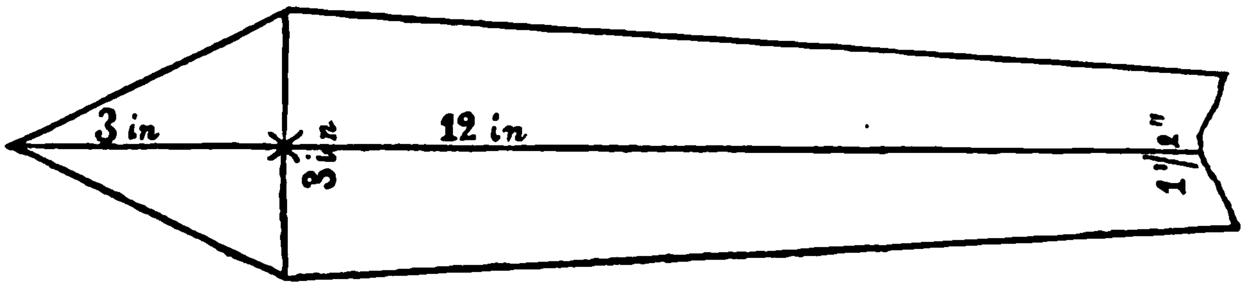
ie result of the trial was, that the speeds of No. 1 and No. 3 were ; but No. 3 was inferior in stability, and sank deeper into the water No. 1, and was less steady in its course.

rom Herapath's Journal, January 17, 1852.
rom the *London Architect for September*, 1851.

Experiment 19.—Two models having the same form of bows as the preceding Nos. (1 and 2,) but with the bodies 12 inches long; one of them with the sides parallel, the other tapered, as exhibited in the diagrams marked Nos. 4 and 5.



No. 4.—Weight 17 oz.; thickness 1½ inch.



No. 5.—Weight 17 oz.; thickness 1½ inch.

When the models (Nos. 4 and 5) were tested together, the speed of No. 5, having tapered sides, was considerably inferior to the one with parallel sides; the proportion in speed of the parallel sides, to that of the tapered sides :: 3 : 2; and as respects stability, the parallel-sided model had very greatly the advantage.

Experiment 20.—Again, experiment made between two models of the same form of bows, &c., as those just tested, but with the bodies of each lengthened to 18 inches; one having the sides parallel, the other tapered; indeed, both after the forms of Nos. 4 and 5, but longer by 6 inches. The weight of each equalled 1 lb. 7 oz.; thickness 1½ inch.

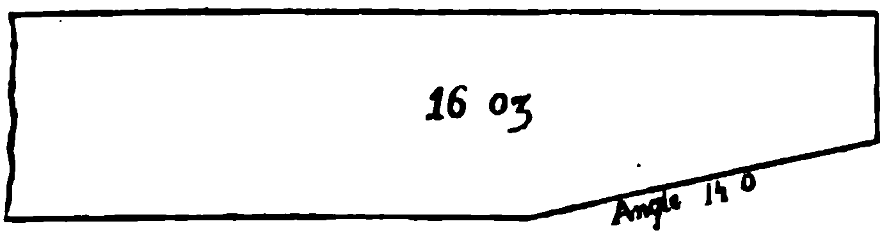
The speed, in this instance, between these models was not so dissimilar as in the trial with the two former models (Nos. 4 and 5); but still the tapering proved injurious, and in the proportion of 5 : 4.

In the experiments here given, they prove most decidedly that tapering the whole length of the body of a ship is very detrimental to speed.

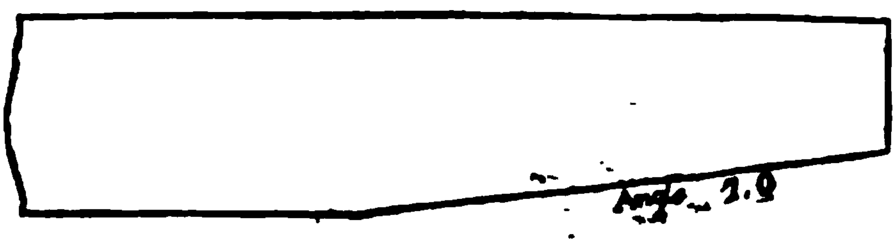
The experiments next undertaken relate to the tapering of the under part or bottoms of ships towards and at the stern.

Experiment 21.—Two models of the same form of bows, and having their respective lengths, breadths, thickness, and weight equal; but one of them cut inclined up an angle of 14°, commencing at one-third of the length from the stern; the other also cut inclined up, but at an angle of 7°, and commencing at the mid-length, as in the diagrams A and B, which when tested together, A beat B in speed a trifle.

A

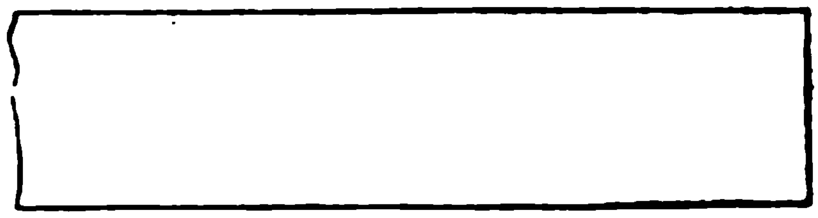


B



Experiment 22.—Again, a third model marked C, of the same dimen- ›ns and weight as A, but the bottom not cut inclined up; upon being sted with A, A had the greater speed of the two.

C



Weight 16 oz.

The model C was then tested with a model E, which differed from C y having its sides towards and at the stern inclined by a gentle curvature, ›mmencing from near the midship. The balance rod gave the speed reatly in favor of the curve sides; for the model E required the addi- onal weight of 2 oz. to be put into it to reduce its speed to an equality 'ith the model C. The weight of each model equalled 16 oz.; therefore ie speed of E was superior to the speed of C by one-eighth the weight.

Experiment 23.—Two models having the same form of bows, likewise e same breadth, length, depth, and weight; but one of them with parallel des and bottom as the model C; the other, with the sides tapered cur- linearly towards and at the stern, and the bottom cut up inclined, and ›mmencing in both instances at one-third or 6 inches from the stern; the ngth of each model 18 inches, and their respective weights 17 oz.

The difference of speed between these two models was great, and on e side of the curvilinear-formed stern, and nearly in the proportion 3 : 2.

Experiment 24.—When the parallel-sided model (the one employed in e last experiment) had its sides made also curvilinear, but not the bot- m, its speed, upon again testing the two last models together, was found be improved very materially.

These latter experiments were tried against each other by weights, as ell as by the difference of the length of lever, and the results were, that e model with curvilinear sides and inclined up bottom, beat in its speed ie model with parallel sides and bottom, as to require the additional eight of 8 oz. to be put into the former to reduce its speed to an equality ith the latter.

Experiment 25.—Upon shaping the parallel sides only to the curvili- ear form of the swifter model, the speed of it was so far increased, in nsequence, that 3 oz. extra weight was then sufficient to equalize the eed of both.

Experiment 26.—The curvilinear sides of the original parallel-sided odel were next reduced to straight lines, the convexity of each being moved; and when tested with the swift model, it was found to be con- derably injured in its speed, having lost by the alteration of the curves straight lines, to the amount of 1½ oz. in weight; because the now raight line tapered stern, required the additional weight of 4½ oz. to be ut into the swifter model, to equalize their speed, instead of 3 oz., when e sides were curvilinear.

The curve employed in the foregoing experiments was the segment of circle, which subtended at the centre of the length of the straight line in he proportion *of ½-inch in 6 inches.* The angle of the tapering, measured *straight lines, was 10°.*

Experiment 27.—Having altered the curvature of the sides in another model, and from the subtension of $\frac{1}{4}$-inch to $\frac{1}{2}$-inch in 6 inches of the length, the speed upon trial was proved to be deteriorated to the amount, in weight, of 1 oz. out of 2 oz., the previous speed, or injured by one-half. Indeed, after many experiments made with the view of thoroughly testing the principle of tapering of the sides and bottoms of models towards and at the stern, the results gave equal benefit; meaning, that when the sides were tapered, the improvement in the speed which followed was, when estimated by weight, equal to 4 oz. And the tapering of the bottom towards and at the stern, produced improvement in the speed likewise equal to 4 oz.; or 8 oz. altogether, in superiority of the model having its sides and bottom continued parallel and level.

(To be Continued.)

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, April 15, 1852.

Samuel V. Merrick, President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from The Royal Society of London; The Royal Geographical Society of London, and The American Institute of New York.

Donations were received from the Royal Geographical Society, London; The Statistical Society, London; The Royal Cornwall Polytechnic Society, Falmouth; The American Institute, City of New York; Hon. John Robbins, jr., Member Congress; Wm. Jackson, Esq.; The Maryland Institute, Baltimore, Maryland; Messrs. D. Appleton & Co, City of New York; John J. Hill, Esq., Albany, New York, and from Messrs. Henry Nolens, Dr. B. H. Rand, Dr. C. M. Wetherill, Geo. Harding, Frederick Graff, Dr. Isaac Parish, Blanchard & Lea, Prof. John F. Frazer, A. N. Macpherson, William Dougherty, and John Livezey, Philadelphia.

A work, entitled "Iconographic Encyclopedia of Science, Literature, and Art," was presented by several members of the Institute.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of March.

The Board of Managers and Standing Committees reported their minutes.

The Special Committees reported progress.

Resignations of membership (3) of the Institute were read and accepted.

New candidates for membership in the Institute (6) were proposed, and the candidates (3) proposed at the last meeting were duly elected.

Dr. Rand, Chairman of the Committee on Meetings, exhibited several photographs on glass taken by the collodion process published in the Glasgow Practical Mechanics' Journal, December, 1851, (Journal Franklin Institute, vol. XXIII, 3d Series, p. 120.) These were taken by Dr. C. M. Cresson, and fully attest the value of this process. Dr. Rand remarked,

it from the improvements suggested by the daily experience of the gen-
men engaged in these experiments, he had no doubt that he should be
le to submit at a future meeting, specimens of this art, which would
esent a decided advance over these brought forward this evening. He
ther called the attention of the members to a beautiful colored talbo-
e from the gallery of Messrs. M'Clees & Germon.

Dr. Rand brought before the meeting the subject of the flavoring of
dulous fruit drops. In these drops the characteristic flavor of the fruit
resented, is so perfectly manifested as to have attracted general re-
rk, being far more natural than in any preparation of the fruits hereto-
e made. He explained that these flavors were due to the presence of
tain ethereal compounds, whose discovery and application to this pur-
se were of recent date; that it was most probable that the flavors of the
its themselves depended on the presence of a very small quantity of
se compounds produced by decomposition as the fruit approached and
sed maturity.

In reply to an inquiry, Dr. Rand remarked that he believed that no
ssible injurious consequences could result to the health from swallowing
minute quantities of these ethers necessary to produce the desired flavor.
e flavor of bitter almonds as used daily, is due to hydrocyanic acid,
e of the most rapid poisons known when concentrated, but harmless
a flavoring substance. Of the injurious effects of acids upon the teeth
d stomach, there could be no doubt, and this was the only objection he
ld perceive against this pleasant article of confectionery.

Dr. C. M. Wetherill exhibited specimens of various ethers, some of
ich were made for commercial purposes, by John Price Wetherill, Esq.,
rest prepared by himself. These ethers were similar to those exhib-
l as flavoring extracts at the World's Fair, and which were examined by
Hoffman.

The pear oil was acetate of oxide of amyle; apple oil, valerianate of
de of amyle, and pineapple oil, butyrate of oxide of ethyle. These
ers require to be diluted with 5 to 7 volumes of alcohol to develope the
uliar flavor of the fruit. Dr. W. explained in full the theory of
alcoholic, amylic, viscous, lactic acid, and butyric acid fermentations;
l illustrated the theory of organic radials by reference to the series of
yle, amyle, and methyle.

Mr. J. Z. A. Wagner presented a new form of brick of his invention,
ring a mortise in its centre. The advantages claimed for this brick
, economy in fuel in its manufacture, less liability to absorb moisture,
ease with which it may be divided, and greater strength of wall con-
ucted of bricks of this form.

Mr. Wagner also exhibited a model of an apparatus intended as a steam
ciliary to sailing vessels.

Mr. George Harding placed on the table a beautiful working model of
Morse line of magnetic telegraph between New York and Washington,
de by Mr. Mason of this city.

Mr. G. W. Smith brought forward specimens of fabrics from the flax
ton of M. Claussen; some of these were composed of the prepared
alone, others with a mixture of wool. Also some specimens of the
terial variously colored.

delphia: Blanchard & Lee. 1852.

The work of which we are here presented with a new editi which at its first appearance took a very high rank among tr Chemistry, which it has preserved to the present time. With n losophical views than those which prevailed in its rival by th Turner, it furnished very full information on the phenomena where entirely lost sight of the fact that it was treating of a sing of a much more extensive science, and that in consequence, tr only be reached by making the connexions of the separate par Graham was, moreover, himself a very successful original inve the domains of this science, and we owe to his ingenuity and much valuable knowledge, which gave his work the freshness v been almost lost in English works upon this science. In no scie ever, is there more constant need of revision and renewal tha mistry; the great number of writers which are attracted by its investigation, and the interest of its results, the innumerable ap in the various branches of art, and its intimate connexion wi physics, insures for it a host of devotees, who are peculiarly ized by industry and patience. Hence, in a treatise on Chemistr is an unusually important attribute; and hence, too, the great bility resting upon an editor, to see that the work under his contains all the most valuable contributions made to the science last appearance. A very hasty glance at the volume before us w any student that these requisites have not been overlooked by author himself or his American editor; and yet there is undoubt for improvement by the introduction of new processes of man chemical products, and new views of their nature, which we for in vain in this volume. It is strange, too, to see, after the ex of so much care, how stereotyped errors escape all notice. These

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JUNE, 1852.

CIVIL ENGINEERING.

Strength of Cisterns and Tie-Rods. WEBB *v.* TOWNS.—*Arbitration.**

The facts of this case are shortly these:—The plaintiff, Mr. Webb, is an extensive malt distiller, carrying on business at West Ham, Essex, and employed the defendant, Mr. Towns, a back-maker, to construct for him a number of wash-backs or cisterns of very large dimensions, constructed to contain the wort or wash, similar to the fermenting tuns at breweries. The plaintiff undertook to provide the iron tie-rods ready for fixing; the defendant was to fix the rods so provided, and provide and fix the timber work. One of these wash-backs (No. 8) suddenly burst in March, 1851, on which occasion the wash, valued at about 300*l.* was lost, and damage to the amount of 341*l.* 15*s.* 8*d.*, was alleged to be done to the premises and plant by the accident. The inside dimensions of the back were:—length, 30 feet; breadth, 20 feet; depth, 13 feet; contents, 40,000 gallons = 1328 barrels = 216 tons weight of fluid; and constructed of Dantzic fir, 3-inch sides, 2-inch bottom, spiked to sides, braced horizontally with three tiers of 1¼-inch tie-rods, longitudinal and transverse, *hooked* together in the middle, with fir cleets and tie-planks; in addition to which were iron bolts passing vertically through the entire thickness of the sides, besides dog-bolts at angles.

The plaintiff's witnesses, consisting of Messrs. Curtis, the builders, and men in their employ, gave evidence that the ties were improperly placed in the back, as regards heights or distances from the bottom; that the

* From the London Builder, No. 476.

rods, 1¼ common English iron, *hooked together in the manner as ordered by plaintiff, were tested by hydraulic pressure to the extent of* 25 *tons, without breaking.*. Mr. Deely, engineer, gave evidence that the tie-rods were improperly placed, and on some other points of construction. Mr. John Braithwaite, civil engineer, gave evidence to the like effect, that the iron tie-rods were sufficient for the purpose; calculated the pressure that possibly could be on the bolts or tie-rods, and found it less than one-half what the bolts ought to stand; was convinced the cause was not the bursting of the bolts, but that this was the consequence; found the back slightly put together; the tie-rods were too far from the bottom, throwing too much pressure on the wood-work of the bottom, the dog-bolts too slight. He concluded that the back gave way in the first instance at the bottom, giving motion to the fluid within, and, according to the degree in which it gave way, *would increase the pressure probably from* 10 *tons up to* 40 *or* 50 *tons, depending on the velocity of the fluid,* and in his opinion was the cause of the accident. The weight on the tie-bolts could not have broken them, even to 20 tons; the breaking strength of the iron was nearer 30 than 20 tons: *did not object to the tie-bolts being hooked.*

Calculated pressure on side upper tier of bolts—

	4 at	3¼ tons each,	13 tons.
Middle	4	6½	26
Lower	4	9¾	39
		Total tons,	78

For the defendant.—His workmen and fellow-tradesmen gave evidence that the materials and workmanship were good, and the backs were constructed in the ordinary and common way—excepting as regarded the method of connecting the tie-rods together in the middle, which, by the special direction and interference of plaintiff, were hooked together, instead of being connected by eye-bolts—and they likewise spoke to the bad quality of the iron, (common English,) which, in turning to form the hook, broke several times.

Mr. Charles Humphreys, surveyor, gave evidence.—The back was constructed in the customary way; that after the accident the side was bulged and convex on the outside, the cleets broken outwardly; that the point of the greatest convexity was in the lowest tier of tie-rods, and that the rupture of the side tore away the bottom, and that the cause of the accident was insufficiency of the tie-rods both as regards the quality of material and the method of connexion, by means of hooks; that all iron loses 75 per cent. of its strength by being hooked, (as shown in a series of experiments instituted especially for the purposes of this trial, by Mr. Heather, M. A. of the Royal Military Schools, with the proving machine, at the dockyard, Woolwich;) that by calculation the pressure on the entire side of the vat was 70 tons; and, deducting for the duty done by the bottom and sides, there would be a pressure of 6 tons on each tie-rod, supposing it possible to insulate each rod, but the side being made rigid, it was not possible so to do; that the tie-rods were equal to a strain of 2 tons only, and broke with 6¼, as shown by experiment; that after the bursting, the pressure of the fluid on the back would rapidly diminish, and would not increase.

Mr. Heather, M. A. of the Royal Military Academy, Woolwich, by a rking model proved that, if any fluid issues from an aperture in the e of a vessel, the pressure on that side is diminished, being consumed he motion of the fluid; that the principle of hooking ties together is entially bad, in consequence of the cross strain on the fibres of the iron, he amount of 75 per cent. on all iron; and that the accident occurred consequence of the insufficiency of the iron tie-rods, as regards quality l construction.

Mr. Davidson, Civil Engineer, gave evidence in confirmation of the ove.

The inquiry lasted nine days, and the arbitrator gave his award for the endant.

The points of this case are especially interesting as regards the common thod of hooking ties together, thereby causing a loss of strength, and wide discrepancy between the experiments performed at *Woolwich ckyard* and by the *ordinary testing machines at foundries.*

periments made at H. B. M. Dockyard, Woolwich, with Messrs. Bramah's Hydraulic Press, in January, 1852, *showing the weakness of hooks.*

COMMON ENGLISH ROUND IRON, 1 3-16 INCHES DIAMETER.

No. 1.—Hooked.

Strain of	4	tons,	no effect.		
"	5	"	opened	⅛	of an inch.
"	5½	"	"	¼	"
"	6	"	"	⅜	"
"	6¼	"	"	½	"
"	6½	"	"	⅝	"
"	6¾	"	"	13-16	"
"	7	"	"	15-16	"
"	7¼	"	broke.		

No. 2.—Straight (same piece).

Strain of	10	tons,	no effect.		
"	16	"	"		
"	18	"	lengthened	5-16	in 2 ft.
"	20	"	"	11-16	"
"	21	"	"	15-16	"
"	22	"	"	1⅛	"
"	23	"	"	1 7-16	"
"	24	"	"	1¾	"
"	25	"	"	2 3-16	"
"	26	"	"	3 1-16	"
"	26½	"	broke.		

No. 3.—Hooked open 1⅜.

Strain of	5½	tons,	no effect.	
"	6	"	opened	⅛
"	6½	"	"	5-16
"	6¾	"	"	⅜
"	7	"	"	½
"	7¼	"	"	⅝
"	7½	"	"	¾
"	7¾	"	"	⅞
"	7⅞	"	broke.	

No. 4.—Straight (same piece as No. 3).

Strain of	16	tons,	no effect.		
"	18	"	lengthened	5-16	in 2 ft.
"	20	"	"	¾	"
"	21	"	"	1	"
"	22	"	"	1¼	"
"	23	"	"	1½	"
"	24	"	"	1⅞	"
"	25	"	"	2⅜	"
"	26	"	"	3⅛	"
"	26⅜	"	broke.		

S. C. CROWN IRON, 1 3-16 INCHES DIAMETER.

No. 5.—Hooked, 1¼ open.

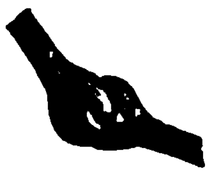
Strain of	5	tons,	opened	3-16
"	6	"	"	½
"	6½	"	"	½
"	7	"	"	⅞
"	7½	"	"	1 1-16
"	8	"	"	1½
"	8¼	"	straightened out.	

No. 6.—Straight (same piece).

Strain of	15	tons,	no effect.	
"	17	"	11-16	in 2 feet.
"	20	"	1	"
"	22	"	1½	"
"	24	"	2¼	"
"	26	"	6¾	" reduced to ⅞ diameter and broke.

BEST MITRE IRON, 1¼ INCHES DIAMETER.

No. 7.—Linked.



Strain of	15	tons,	stretched	⅛ in 3 feet.
"	16	"	"	3-16 "
"	17	"	"	½ "
"	18	"	"	11-16 "
"	19	"	"	1 "
"	20	"	"	1¼ "
"	21	"	"	1⅜ "
"	22	"	"	2 "
"	23	" broke.		

No. 8.—Straight (same as No. 7).

Strain of	23	tons,	stretched	3-16
"	24	"	"	7-16
"	25	"	"	¾ broke.

No. 9.—Same as No. 7, linked.

Strain of	15	tons,	stretched	⅛ in 3 feet.
"	16	"	"	¼ "
"	17	"	"	½ "
"	18	"	"	⅝ "
"	19	"	"	⅞ "
"	20	" broke.		

No. 10.—Straight.

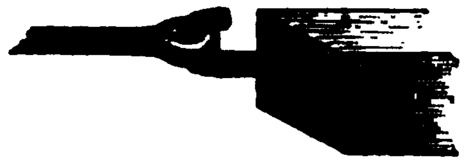
Strain of	20	tons, no effect.		
"	21	"	stretched	1-16
"	22	"	"	¼
"	23	"	"	⅜
"	24	"	"	9-16
"	25	"	"	1
"	25½	" broke.		

MR. WEBB'S IRON, 1 3-16 INCHES DIAMETER.

No. 11.—A Double Hook.

Strain of	2 tons,	1 hook opened:	2d hook.
"	2 1-16	"	none.
"	3 1-16	"	1-16
"	4	broke.	

No. 12.



Strain of	2	tons, no effect.	
"	3	"	1-16 opened.
"	4	"	3-16 "
"	5	"	½ "
"	6	"	1⅛ "
"	6¼	" broke.	

MR. TOWNS' IRON MITRE, ROUND, 1 5-16.

No. 13.—Flat Eye, Hook, and Key.

Strain of 8 tons, no opening.
" 16 " broke at angle.

Note.—As (1 5-16)² Iron : 16 Tons :: (1 3-16)² Iron : 13 Tons.

No. 14.—Same piece straight.

Strain of 30 tons, stretched 1-16 in 10 in
" 30⅞ " broke.

Note. As (1 5-16)² : (1 3-16)² :: 30 Tons : 24 6-11 Tons

---

*Experiments with the Submarine Telegraph.**

On Monday last, by permission of the Directors of the Submarine Telegraph between England and France, a series of interesting experiments were made by Mr. Reid, telegraph engineer, of University street, London for the purpose of testing a pair of double-needle instruments and two new batteries which he had constructed. One of these instruments was placed in the Company's office at Dover, and the other in the French office at Calais, with a battery to each. Two of the submarine wires were then connected with the instruments, and put in circuit with the batteries. The length of the submarine cable in the Channel is about 24 miles, and

* From the London Mechanics' Magazine, for March, 1852.

out five miles of land telegraph on each side, making, in round numrs, a circuit of 68 miles. The battery that was to work this distance rmed a strong contrast to the present battery now in use, the length ing only 4 inches by 1½ deep, and the weight 1 lb. 5 oz., while the l common battery used on the lines is 36 inches long, 7½ inches wide, inches deep, and weighs 64 lbs. Some of the telegraph clerks in the fice smiled incredulously when Mr. Reid connected the miniature batry with the instrument, but were surprised to find the signals to and om Dover and Calais quite equal to the signals they were receiving om their former batteries. The next experiment was for the purpose of sting an improvement in the double-needle instrument, and will require e utmost stretch of faith on the part of our readers to believe. It was s follows: The miniature batteries were removed from the instruments n each side of the Channel, and a piece of zinc, three-fourths of an inch square, and a piece of silver to correspond, were then introduced into the mouth of the operator at the office in Dover, and instructions sent to do he same at Calais. The wires attached to these pieces of metal were hen connected with the instruments, and by this simple means, and by the simplest of all batteries, the telegraph clerks sent several messages to nd fro from England to France. The next experiment was similar to his, only a larger piece of zinc and a larger piece of silver were introluced into the mouth of the operator. The result was an improvement of he signals. The next day, March 2, the experiments were repeated with he same success. The instruments with the miniature batteries transmited all the commercial messages, price of stock, funds, &c., till 1 o'clock, vhen they were packed up and sent to London. It was thought that luring these operations the miniature battery would become exhausted; n the reverse, it improved, and seemed perfectly to maintain its characr. From these experiments we may conclude a new revolution is in rogress with telegraphs and batteries. They will become more simple, ore easy to understand, and will eventually not only become as familiar household words, but familiar and useful as household servants.

Account of the Progress made in the Drainage of Haarlem Meer during the last year. By T. Grainger, C. E.*

This short paper, in continuation of Mr. Grainger's description of the inage of Haarlem Meer, in North Holland, was read by the Secretary. er describing the difficulties to be encountered in the prosecution of great undertaking, from the size of the lake, and principally from circumstance that its level, even at the surface, was considerably be- that of the sea, so that the whole of the water had to be raised to such eight as would enable it to reach the sea by its own gravity, Mr. inger alluded, in general terms, to the various works undertaken to ct the object in view, such as the canal, 33 miles long, 124 to 147 in width, and 10 feet in depth, with which the lake had been surnded to convey the pumped-up water to the sea—to receive the drain- of the district—and to maintain the internal water communication

* From the London Civil Engineer and Architect's Journal, April, 1852.

previously afforded by the lake itself—and also to the three gigantic steam engines, 360 horse power each, erected at different points of the lake, giving motion to 27 pumps, which raise 186 tons of water at each stroke. The canal and all the other preliminary works having been completed, the pumping was commenced in May, 1848, from which date to 30th April, 1851, the lake had been lowered 7 feet 3 inches, which was the state of matters when the subject was last brought before the Society. During the months of May, June, July, August, September, and October, very satisfactory progress was made, notwithstanding that a considerable quantity of rain fell in August and September, the level reached at the end of October being 9 feet 7·74 inches below the original surface, or at an average rate of 4·79 inches per month. In November a great quantity of rain and snow fell, raising the level about 4 inches; and in December the weather was still unfavorable, so that at the end of that month the level stood at 9 feet 5·58 inches below the original surface, or a total gain since April 30th of 2 feet 2·58 inches, or 3·32 inches per month. This progress may appear to be inconsiderable; but, when it is recollected that the lowering of the lake one inch involves the raising of upwards of four millions of tons of water, and allowing for the rain and snow falling during these eight months, there could not have been less than 186,000,000 tons of water pumped up during that period, the performance will appear great indeed. To give a better idea of this, it was stated that 186,000,000 tons is equal to a mass of solid rock one mile square and 100 feet high, allowing 15 cubic feet to a ton. The average progress has been less last year than what it was in the preceding one; but this is readily accounted for by the *increased lift* of the pumps, and by the difficulty of forming the channels which lead the water to them. At the commencement of these operations, the average depth of the lake was 13 feet 1·44 inches, and as 9 feet 5·58 inches have been pumped out, there only remained at the end of December last an average depth of 3 feet 7·786 inches. It is therefore trusted that the drainage will be completed, if not in the autumn of this year, at least in the summer of 1853. A paragraph has been going the round of the newspapers about disastrous accidents to the boilers, which will delay the completion of the works for two or three years. It was stated that there were no grounds for such rumors, as the official report for January, which Mr. Grainger had received, mentioned that the boilers of only one of the engines (the Lynden) were out of repair, and that it was expected that these would be repaired by February; so that, by this time, it is hoped that the whole of the engines are again at work.—*Proc. Roy. Scot. Soc. Arts*, *March* 8, 1852.

AMERICAN PATENTS.

List of American Patents which issued from April 6th to April 27th, 1852, (*inclusive*,) *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improved Lock;* Albert Betteley, Boston, Massachusetts, April 6.

Claim.—"What I claim as my invention is, 1st, Holding the tumblers rigidly, so that they cannot be moved when the keyhole is exposed, by means of a cam placed on the *same shaft* with the cam which moves the bolt.

"2d, I claim so arranging the tumblers with the key, that the tumblers will form themves into the right position, so that the bolt can be withdrawn, by dropping by their own ight, or being pressed by springs upon the key, as herein above described."

For *Improvements in Saw Mills;* William C. Bronson, Erwin, New York, April 6.

Claim.—"What I claim as my invention is, the construction of a saw frame or gate of tal tubes, constituting the guides as well as the uprights of said frame, and cross pieces heads united to said uprights, in the manner set forth.

"I also claim the arrangement of the cross hooked bar and hooks on the ends of the ws, in combination with the sustaining side bars and upper open plate, for the purpose d in the manner substantially set forth in the foregoing specification and accompanying awings."

For *Improvements in Spinning Bait for Catching Fish;* John T. Buel, Whitehall, New York, April 6.

Claim.—"Having thus described my improved revolving fish or fly, I wish it to be distctly understood that I do not claim what is called a spoon, minner, or the common fly, these having been used before; but what I do claim as new is, 1st, Constructing a bait th an air-tight chamber, which chamber is provided with an aperture or apertures for e admission of air when fishing light, near or on the surface of the water, and for the mission of water when it is desired to fish deep under the surface of the water, substanlly as described.

"2d, I do not claim passing the line loosely through a cork or float, that the float may ove freely upon the line; neither do I claim attaching a spinning bait to the line by eans of a swivel; but what I do claim is, passing the line through a tube in the body of spinning bait, in the manner substantially as described, to enable the bait to twirl freely thout twisting the line."

For an *Improvement in Stone Cutting Machines;* John W. Cochran, Williamsburg, New York, April 6.

Claim.—"What I claim as my invention is, 1st, Cutter jaws or their equivalent, comned with and carrying a cutter across the stone, in the segment of a circle, the cutter ing so set that the part of its periphery in contact with the stone, when cutting, inclines wards, and the part of the periphery opposite thereto, from the axis or centre of motion the cutter jaws, for the purpose set forth.

"2d, The application of revolving cutters to dressing stone, moving and cutting in a rved line across the stone, and on a convex edge of the undressed portion of the surface rmed by the line of cut, and cutting towards the centre of motion of the cutters in such rved line.

"3d, The combination of a rock shaft with cutter jaws, to carry the cutters over and ear from the undressed portion of the stone, substantially as described and for the purses set forth.

"4th, The combination of the rock shaft, guide table, and friction rollers, and their uivalents, substantially as described and for the purpose set forth.

"5th, The combination of the rock shaft and cam and roller, to produce the rocking or mbling motion, substantially as described."

For an *Apparatus for Closing Doors;* Minard Thurston Cooper, Ballston Spa, New York, April 6.

Claim.—"What I claim as my invention is, the combination of the heavy roller upon vibrating arm with the turning railway or inclined plane, the former attached to the oor, and the latter to the casing, and the whole operating substantially in the manner and r the purpose herein described."

For an *Improvement in Horse Collars;* Henry B. Latham, Huntington, New York, April 6.

Claim.—"1st, I claim the spring 9, and staples 10, to connect the upper ends of the mes, as described and shown.

"2d, I claim so constructing and fitting the collar and hame, that the hame shall work or slide on the collar by any jerk or lurching of the harness, for the purpose of relieving the animal; said collar and hame being fitted with the rivets 1 and 2, or their equivalents, to allow the one to slide on the other, and being connected by the bolts 5, or their equivalents, as described and shown."

7. For an *Improved Method of Attaching Roses for Knobs to Doors, &c.;* Nathan Matthews, Assignor to Richard Edwards, David A Morris, and Nathan Matthews, Pittsburg, Pennsylvania, April 6.

Claim.—"I do not claim the mere employment of a dovetail joint, for securing the circle plate in its place; but I claim as new the combination, substantially as described, of the circle plate, having dovetails on its inner face, the dovetails, which are fast on the door or other object, and the shank or socket of the knob, or what is equivalent, any spindle or shaft, attached to the knob or handle."

8. For an *Improvement in Coat Forms;* William B. Olds, Meriden, Connecticut, April 6.

Claim.—"What I claim as my invention is, the bow, C, substantially as described, suspended by a shank at a point distant horizontally from its vertex, on a pivot or its equivalent, which is stationary in a bracket, or any suitable standard or pendant, so placed or constructed as to allow the bow to turn round in any direction, as and for the purposes herein set forth."

9. For an *Improvement in Moth Traps to Bee Hives;* Ebenezer W. Phelps, Newark, Ohio, April 6.

Claim.—"I claim the peculiar construction of the moth trap as herein described, composed of a slide, having the centre groove and two side grooves, and the metallic hinged cover, arranged all as set forth in the specification."

10. For an *Improvement in Buttons, Studs, &c.;* David Rait, City of New York, April 6.

Claim.—"What I claim as my invention is, making a stud, button, or other similar fastening or article of jewellery, in two parts, one part carrying a tube, and the other part with two snap springs, operating in the manner substantially as set forth."

11. For an *Improvement in Smut Machines;* Daniel Shaw, Cheshire, Ohio, April 6.

"The nature of my invention consists in an improvement, by which the light grain and cheat is perfectly and effectually separated from the smut, dust, chaff, and other impurities, at one single operation."

Claim.—"Having thus fully described the construction and operation of my combined smut and grain separator, what I claim therein as new is, the offset, that is to say, enlarging the space of the hollow trunk on the opposite side thereof from that at which the grain is admitted, in combination with the screen *e*, spout *f*, and the passage and valve *g'*, for taking the dust, &c., into the fan case, whereby the cheat and light grain, which will pass up the spout, with the impurities, is effectually separated, and delivered through the spout *f*, substantially as herein fully set forth."

12. For an *Improved Harpoon;* J. D. B. Stillman, City of New York, April 6.

Claim.—"I do not claim making the flukes separate from the point, or causing the latter to enter deeper than the former into the body of the whale; but what I do claim as my invention is, the combination of the sliding and unlatching flukes with the lance, and the lines, or their equivalents, by means of which the point is driven deeper by the drag or traction on the line, substantially in the manner herein described."

13. For *Improved Mechanism for Actuating an Adjustable Eccentric;* Matthew Stubbs, Cincinnati, Ohio, April 6.

Claim.—"Having thus described the nature of my improvements in the valve gearing *of steam engines,* I wish it to be understood that I make no claim to an adjustable sheeve,

e use of a screw in this connexion; but what I claim herein as new are, the herein l devices for the adjustment of an eccentric sheeve, that is to say, the sheeve stock, so as to traverse a bed-plate at right angles to the shaft or axle, and operated by ar through the medium of suitable levers, and yoke, connected with a sliding om which projects a rack, which gears into a pinion upon the screw, which actu- sheeve; and this I claim, whether or not the same be combined with the vibrating shifting pin, as herein represented; for variation of the throw."

---

an *Improvement in Grain Separators;* John Thompson, Chili, New York, il 6.

.—"Having thus fully described my improved threshing machine, what I claim s new is, the novel arrangement for separating the grain from the straw, by which provided with teeth have a rotary and lateral motion, said motion produced sub- r as described, or in any equivalent manner, in combination with the inclined ereby, by their combined action, the grain is perfectly and rapidly separated from r, operating in the manner and for the purpose herein fully set forth."

---

an *Improvement in Boot Jacks;* Sardis Thomson, Hartsville, Massachusetts, il 6.

.—"Having thus described my invention, what I claim as new is, 1st, The heel nd stirrup, in combination with the lever, to draw the stirrup over and hold the e boot, in the manner and for the purpose set forth.

claim the movable heel gripper, in combination with the connecting rod and onstructed and operating substantially the same as described and represented."

---

an *Improvement in Seed Planters;* Jesse Urmy, Wilmington, Delaware, April 6.

.—"Having thus fully described my improved machinery for seeding, what I rein is, the jointed tooth attached to the beam, as shown in fig. 7, in combination swiveling bifurcated spout, to direct the corn as above specified, for ribbed seeding.

claim the combination and arrangement of the counter with the clutch, as de- o that the counting shall stop when the seed is not delivered.

claim the finger register and its appurtenances, as above described, for regulating tity of seed delivered.

claim, in combination with the seeding apparatus, the pulverizer, for guano, &c., ed and arranged as set forth."

Improvements in Rails and Car Wheels; John Valentine, City of New York, il 6.

nvention consists in a new and improved method of constructing wooden rail- d carriages adapted to run upon the same."

.—"What I claim, therefore, as my invention is, the guide wheels, in combination rail, constructed as described, and the carriage; said wheels having their circum- beveled, so as to expose two surfaces to roll upon; one to project against the side il, and the other to come in action upon the surface of the inner strip forming e chair, when the guide wheels become burthen wheels, as described; the whole structed and operating substantially in the manner herein set forth."

---

an *Improvement in Cultivators;* T. J. Ball and John Post, Pittsfield, Michigan, il 6.

.—"What we claim as our invention is, the construction of the long metallic blades on the after part of the machine, for cutting the sods and lumps, and pul- the ground, as set forth."

Improvements in Drop Punches; Solomon Andrews, Perth Amboy, New Jersey, il 13.

nature of my invention consists in the peculiar construction of the drop punch mode of lifting and discharging it."

Claim.—"I do not claim constructing the hammer with a long stem, and making the same serve as guides; but I claim as my invention, the hammer or drop, provided at the same time with a stem to serve as one of its guides, and one guide on each side, at or near its lower end, substantially as herein specified.

"I also claim as my invention, the manner of lifting and discharging the hammer, or drop, by means of the cogs in its stem, and the pinion operating therein; the fall of the hammer or drop, bringing the said pinion into gear with the motive power, and its upward motion releasing or discharging it threfrom, at any given point, substantially as herein described."

---

20. For *Improvements in Hinges;* William Baker, Utica, New York, April 13.

Claim.—"I do not claim as new, simply constructing the window blind hinge, with its screw plates so arranged as to be secured to the back of the blind and the outside of the window casing; but I claim the bridge or inclined plane at the base of the pin, and the corresponding elongation of the eye, operating upon and in connexion with the hook and catch attached and connected in the manner described; the whole forming a fastening, and the mode of operating the same; the fastening taking hold of, and pulling directly upon the window casing and the blind, and thus relieving the hinge as described.

"I claim the use of the bridge, or inclined plane, at the base of the pin, and the elongation of the eye as described, for disengaging the blind fastening independent of its connexion with my fastening, as above described, and whether the fastening is connected with the hinge or not; the whole being constructed and arranged substantially in the manner above set forth."

---

21. For an *Improvement in Machines for Tonguing Boards;* Ransom Crosby & Henry D. Edgecomb, Assignors to Ransom Crosby Jr., City of New York, April 13.

Claim.—"Having thus fully described our apparatus, what we claim therein as new is, the arrangement of two sets of stationary vibrating cutters for tonguing boards in separate stocks, substantially as herein described, with a space between them for the escape of shavings, the sides of the stock being substantially parallel to the face of the board and each other, and the surfaces of their soles being substantially perpendicular thereto, the plane irons being inclined in the usual way, to the soles and backs of the stocks and the cutters, in their length, being substantially parallel to the sides thereof. We are aware that two sets of cutters, in separate stocks, have been differently arranged and for an analogous purpose, and we therefore do not claim them, except in the arrangement and position, substantially as above described."

---

22. For *Improvements in the Method of Welding Steel, &c., to Cast Iron;* Mark Fisher and John H. Norris, Trenton, New Jersey, April 13.

Claim.—"Having thus described our improved apparatus for the manufacture of articles of cast iron, with steel or wrought iron welded thereto, what we claim as our invention is, first, the metal box or frame for sustaining the steel in place, and forming the cell below it; and, secondly, securing the steel in place by means of the clamps, in the manner above described."

---

23. For *Improvements in Mills for Curvilinear Sawing;* James Hamilton, City of New York, April 13; patented in England, June 1, 1848.

"The invention consists, first, of means of supporting timber, when being cut to various bevels.

"Secondly, The invention consists of chucks, or apparatus, for holding timber at the ends, when being cut or sided, and in supporting such chucks.

"Lastly, The invention consists of improvements in apparatus for indicating the directions or bevels to which timber is to be cut."

Claim.—"What I claim as my invention is, connecting the supporting roller with the lever which forces it up against the under side of the log, by means of a joint and a segment slot, and securing bolt, or the equivalents thereof, substantially as specified, so that the said roller can be inclined in any desired direction from a horizontal line, to suit the inclination of the underside of the log, and there secured, to give efficient support, as set forth.

in extending the chucks for supporting the ends of curved logs below the blocks, so that the ends of such logs in siding may be supported below the head and tail blocks, to bring the upper curved part within the range of saw, substantially as specified, when this is combined with the middle supm which the lower part of the chucks rest, and by which they are supported eration, as set forth.

lly, in the method of indicating the bevels and keeping the log to them as wed, I claim the index hand, whose axis of motion is in a line, or nearly so, of rotation of the log, substantially as specified, in combination with either vers, which have the same axis of motion as the index hand, and the adjustng inclined ways, substantially as specified, so that as the carriage advances the passage of the side lever (whether on one side or the other,) on the inset to the required bevel, will shift the index hand and indicate the true bevel, operator to turn the log to correspond, as set forth."

---

rovements in Machinery for Making Casks; James Hamilton, City of New April 13.

"Having thus specified the various parts of my invention, and the manner of and using the same, what I claim as my invention is as follows, viz: The ve staves from one block, by means of two saws, which in succession enter f, then, in succession, diverge in opposite directions, and finally converge and he same kerf, substantially as specified, the two saws being mounted substancified, so that they can be moved laterally in opposite directions, in combinas templates or their equivalents, for giving the required lateral motions to the block of wood is moved forward towards the saws, substantially as specified; inery for boring holes for dowel pins, I claim the arrangement of the mandrels bits on separate slides, to admit of varying their distance apart, substantially in combination with the reversible fence or gauge, hung to a rock-shaft, a slide between the mandrels, and provided with the means of adjustment, as specified, by means of which the bits can be set at pleasure, to bore the desired distance apart, and on the two edges, to correspond, the distance being the same end, with the view to economize timber, as specified.

nachinery for jointing staves, I claim, in combination with the circular saw, ged carriage, which is governed by guides, to determine the form to be given, , the employment of the gauging apparatus to determine the quantity of stuff f, and the gauge piece with its two points, and made adjustable on the carriage, y as specified, by means of which combination, the quantity of stuff to be cut each edge, is regulated to prevent waste, and an equal width of the two ends ien cutting the second edge, as set forth.

nachine for setting up the staves and driving on the hoops, I claim the spring d to the weight or head on the sliding shaft, or the equivalents thereof, the eing formed with lips inside to support the hoop whilst setting up the staves, , when the said arms are combined with the cam plate, or the equivalent therepurpose of liberating the arms from the hoop, that they may be employed for the hoop, substantially as specified.

ally, in the machinery for turning the heads, I claim, in combination with the for receiving the head, and the clamping piece for clamping it against the chuck, ly as specified, or the equivalents thereof, the employment of the jaws, operated or their equivalents, for the purpose of forcing together the different pieces cone head, preparatory to clamping them on the chuck and turning the head, subd for the purpose specified."

---

provements in Looms for Weaving Figured Fabrics; Barton H. Jenks, burgh, and Robert Burns Goodyer, Philadelphia, Assignors to Barton H. Jenks, burgh, Pennsylvania, April 13.

—"What we claim as our invention is, 1st, The method of moving both picker loom simultaneously and at each beat of the lay by the mechanism herein dethe equivalent thereof, whereby a shuttle may be thrown from either side of the h beat of the lay, and the momentum of the picker motion at one side of the nterbalanced by that of the other picker motion at the opposite side of the

loom, the mechanism operating in such manner, that both the pickers are free to retreat to the outer ends of the shuttle boxes, the instant the shuttle is thrown, substantially as specified.

"2d, The combination of the pattern wheel U, arm W, doubled armed lever R, crosshead M, and stop L, operating substantially as herein set forth, to effect the shifting of the shuttle boxes, as herein set forth.

"3d, The combination of the forked marches, reciprocating levers, pattern drum and evening pin, substantially as herein set forth, to effect the working of the heddles from the shed, as herein set forth.

"4th, The combination of the supplementary arms on the cam shaft and pins upon the star wheel, or the equivalent thereof, operating substantially as herein set forth, to vary the number of changes of which the heddle mechanism is susceptible.

"5th, The combination of a fork and grid motion for effecting the stopping of the loom, when the weft thread breaks, as the shuttle is moving towards one side of the loom with the shifting plate lever, operating substantially as described, for preventing the loom from being stopped by the fork and grid motion, when the shuttle is thrown towards the side of the loom further therefrom.

"6th, The combination of the long rock shaft on the lay, with its arms, toes and levers, and of the chain lever and chain, with the breast beam lever, or the equivalents thereof, operating substantially as described, to effect the stopping of the loom when the shuttle is not in its proper shuttle box, at the time the lay is beating up, and also whenever the shuttle has not been ejected from its box, at the time the lay is completing its back stroke, as herein set forth."

---

26. For *Improvements in Reeling Machines;* Elias & Simeon Macy, Laurel, Indiana, April 13.

Claim.—"We do not claim to have invented a self-acting stop motion, to stop the machine when a given length of yarn has been wound upon the reel, this having already been applied to machines similar to ours; but what we do claim is, constructing and arranging the stop motion substantially as described, so that by adjusting it, the length of yarn wound upon the reel before it is stopped may be regulated at pleasure, and all the skeins wound under the same adjustment will have the same length."

---

27. For *Improvements in Sewing Machines;* Isaac M. Singer, City of New York, April 13.

Claim.—"Having thus fully described my additional improvements, what I claim therein as new is, 1st, the cut-off friction pad, constructed and operating substantially in the manner and for the purpose set forth.

"I also claim the construction and arrangement of the feeding apparatus, as above described."

---

28. For an *Improvement in Seed Planters;* B. T. Stowell and A. Marcellus, Waddam's Grove, Illinois, April 13.

Claim.—"What we claim as our invention is, 1st, the application of the dibbles, &c., constructed and arranged as described, to the peripheries of the wheel, and operating in the manner herein set forth.

"We also claim the peculiar arrangement for feeding the seed to the hills, consisting substantially of the pistons and tubes, regulated by the coiled springs and bars, and operating as herein set forth."

---

29. For an *Improvement in an Instrument for Opening Boxes;* George C. Taft, Worcester, Massachusetts, April 13.

Claim.—"What I claim as my invention in the above described instrument for opening boxes is, the tapering score, I, cut in both jaws, but smaller in the upper one, or F, so constructed that when both jaws are driven in between the side and lid of a box, the points of the jaws pass on each side of the nail, which will be griped in the score, I, so that as the jaw, F, is raised to take up the lid, it will draw the nail out of the side, and thus prevent the head of the nail from being drawn through the lid as it rises, while the jaw, G, rests upon the side of the box, substantially as described.

"2d, Is the tapering score, I, in combination with the peculiar construction and arrangement of the jaws, F and G, the latter being furnished with a recess at H, into which the mer closes, in the manner and for the purposes herein set forth."

. For an *Improvement in Seed Planters;* Francis Vandoren, Adrian, Michigan, April 13.

Claim.—"Having thus fully described my improved seeding apparatus and cultivator, at I claim therein as new is, the hollow reversing tooth, constructed in the manner and the purpose set forth."

. For an *Improved Oblique Bucket Paddle Wheel;* George S. Weeks, Oswego, New York, April 13.

Claim.—"I do not claim placing the paddles in oblique positions to the axis of the heel, as this has been done before; nor do I claim two sets of paddles inclining obliquely opposite directions, and all at the same distance from the centre of the wheel: but what do claim as my invention is, the arrangement of two series of adversely inclining oblique addles, one within the other, in the construction of steamboat wheels, substantially as erein set forth."

2. For an *Improvement in the Feed Apparatus of Planing Machines;* Joel Whitney, Winchester, Massachusetts, April 13.

Claim.—"I do not claim gearing the feed rollers with each other, by means of pairs of iovable pinions connected to each other and to the feed rollers by links, this having already een done, for the purpose of giving large play to said feed rollers: but having described ly improvements, what I claim as my invention is, the arrangement by which the upper ed roll is allowed to yield to any inequalities in the board, and at the same time draw own upon the surface, to which it has yielded, in proportion to the resistance to the cutng tools, that is, connecting the fixed shaft with the vertical sliding bearings of the upper ed roll, by means of the swinging inclined and vertical arms, the gears on the fixed shaft perating the lower feed roll, and also playing into the gears which move the upper feed oll; said latter gears having their bearings in the intersection or joint of the said arms, the rrangement being substantially as herein above set forth."

13. For *Improvements in Submarine Augers;* Norman Blake, Ira, New York, April 20.

Claim.—"Having thus described my invention, what I claim is, forming a pod auger with a hinge joint, E, in combination with connecting wires, substantially in the manner and for the purposes set forth and shown."

14. For an *Improvement in Mattrasses;* Thomas G. Clinton, Cincinnati, Ohio, April 20.

Claim.—"Having thus complied with the Patent Laws of the United States, in the matter of my discovery, treated at length in the specification of description in the drawngs annexed thereto, and made part of the same, what I claim is, the use of the hair of ides of cattle, treated after the manner of, or steeped with the hides of cattle in the limeats of a tan-yard or other suitable place, as described, with or without other animal or egetable matter, treated or not treated conjointly therewith, or separately, in the same ay; and the use of other animal or vegetable matter, under like treatment and circumtances as described, whether used conglomerately, conjointly, or separately, or their equialents, when such animal or vegetable matter is of the kinds used for upholstering or leeping purposes, in the articles of mattrasses, ottomans, cushions, sleeping sofas, sacking ottoms, or analogous articles, whereby a new result is attained, viz: an article obnoxious o bed-bugs, without the necessity of any temporary application of poisionous mixtures hereto; thus furnishing the world with a harmless antidote to a great nuisance, and bolishing the necessity for a great peril to human life in the domestic circle."

15. For an *Improvement in Winnowers;* Thomas J. Doyle, Winchester, Virginia, April 20.

Claim.—"What I claim as my invention and improvements are, 1st, in combination

with the side openings, discharge outlets, or passages, *o o*, diagram, E, the invention, use, and application of the sliding diaphragm, with double sloping bottom, *p p p*, in diagram, E. This diaphragm bottom, as shown and used, has a double slope, or is a double inclined plane outward, inclining from each side of its elevated longitudinal centre.

"2d, I claim the use, application, and arrangement of an adjustable or sliding cheat or smut board, as shown in diagrams, C and F, and the same also in combination with the top screen, No. 1, with side apertures or outlets, *o o*, as shown in diagram, E, for the purpose as herein before fully specified."

---

36. For a *Sash Stopper and Fastener;* Charles C. Felton, Dedham, Massachusetts, April 20.

Claim.—"I do not claim the combination of a rocking or vibrating friction plate, a lever spring, and notched plate, as they are arranged in the drawings of the patent granted to B. S. Hadaway; but as I dispense entirely with a lever separate from the rocking friction plate, and make the said plate to operate itself, I claim my improvement of combining the rocking plate, F, and lever, in one single piece, and extending it below the part which rocks on the part, *b*, of the notch of the catch plate, all essentially in manner as described, whereby I greatly simplify the construction of the window catch, and thereby render it not only cheaper in construction, but less liable to get out of order."

---

37. For an *Improvement in Protecting Wheels and Axles of Cars, by Incasing them;* A. L. Finch, New Britain, Connecticut, April 20.

"The nature of my invention consists in the employment of metallic cylindrical tubes and casings, in which the axles and wheels of railroad cars are incased and secured, and also allowed to turn freely. The object effected by this invention is, the prevention of the very serious consequences which ensue from the accidents so often occurring on railroads, occasioned by the breaking of the wheels and axles of rail cars."

Claim.—"Having thus fully described the nature and application of my invention, what I claim as new is, incasing the axles and wheels of rail cars within a metallic casing, substantially as and for the purposes herein specified."

---

38. For an *Improvement in the Keys of Piano Fortes, Organs, &c.;* William F. Furgang, Albany, New York, April 20.

Claim.—"I claim the improvement of the finger keys of organs, piano fortes, or any other musical instrument played in a similar manner, by constructing a part of every key in such a manner, that when in position on the key board, such part of every key shall be both level and in range with the similar parts of the other keys, so that the running of a finger over the keys of the whole chromatic scale on the key board, may be capable of producing similar effects to those that can now be produced by a similar running of a finger over the lower range of keys of piano fortes as now constructed, substantially in manner and form as set forth in the above specifiation."

---

39. For an *Improved Capping of Screws;* Charles T. Grilley, New Haven, Connecticut, April 20.

"My improvement consists in the combination of a brass, copper, or plated cap, with an iron-wood screw, to the head of which it is attached as hereinafter described, in such manner as to unite with the strength and comparative cheapness of an iron screw, an external appearance and beauty, when inserted, similar and in all respects equal to that of screws made wholly of brass, copper, or plated metal."

Claim.—"I do not claim as my invention the adaptation simply of a cap of sheet metal to the particular configuration of any regular or irregular form, by compression, or in whatever other manner the same may be produced; but what I do claim as my invention is, the attachment of a brass, copper, or other suitable metallic cap, to and in combination with an iron-wood screw, substantially in the manner and by the process described in the foregoing specification, (which I conceive to be the only practicable method in which the same can be usefully effected,) whereby, and by means of the successive operations of punching or stamping, the nick is first cut through the shell, and then, after being adjusted to the *groove or slot* in the head of the screw, the sides thereof are driven down into and made

press closely against the sides of the slot, leaving the bottom of the groove or slot unvered, so that the cap, when closed round the head of the screw, will preserve its hold, witht liability to be turned or displaced by the screw-driver, which works upon the iron surface the bottom of the slot, and against the covered sides thereof; thereby furnishing to the blic, at a comparatively small cost, a wood screw, having all the beauty and finish of a ass, copper, or plated screw, in combination with the greatly superior strength of an iron ie. The invention is equally applicable to steel screws, which may be capped in a similar ay."

). For an *Improvement in Machines for Drawing Spikes;* Daniel Hale, Hinsdale, New York, April 20.

Claim.—"Having thus explained and described my invention, what I claim is, the shackle, ith the arrangement for clasping the head of a spike, for the purpose of drawing it from ie cross-tie of a railroad track, in combination with the clevy and the lever, substantially as erein before described and set forth."

---

1. For an *Improvement in Apparatus for Raising Water;* N. H. Lebby, Charleston, South Carolina, April 20.

"The nature of my invention consists in constructing the turbine with ribs on the outer ice of its upper disk, which ribs, working under a cover to the wheel, cause, by the centriigal effect produced while in motion, a void to be formed at or about the centre, the tenency of which will be to relieve the wheel of its weight, and consequently reduce the inning friction."

Claim.—"What I claim as my invention is, constructing the wheel or turbine with exteor ribs, of any suitable number, size, or shape; the said ribs operating in combination with cover or its equivalent, in the manner and for the purposes substantially as set forth."

---

2. For an *Improvement in Refrigerators;* Andrew Maish, Cincinnati, Ohio, April 20.

Claim.—"I am aware that ice safes have been made with hollow shelves for water, but iese are practically objectionable, on account of their costliness, cumbersomeness, diffiulty of cleaning, and liability to twisting, either from the congelation of the water, in the vent of the discharge becoming choked, or from the hydrostatic pressure: but what I claim herein as new is, the application, as herein described, to an ice safe or refrigerator, of a rimped, convoluted, or corrugated form, to the shelves, in order (in addition to combining trength with lightness of construction) to capacitate them for the collection, retention, nd discharge of the water, which results both from the ice and from the atmospheric ioisture within the case."

---

3. For an *Improvement in Brick Machines;* Jesse Samuels, Allentown, Pennsylvania, April 20.

"My invention consists, 1st, in an improved feeding arrangement, by which the desired uantity of clay to fill the moulds can be regulated to a nicety, in connexion with a lunger, which partially condenses the clay into the moulds preparatory to pressing.

"2d, In the novel device or arrangement for clamping, removing the brick from the ioulds, and placing them on a platform or apron, which I denominate a carrier."

Claim.—"Having thus fully described my invention and the manner of constructing he same, what I claim therein as new is, the manner of feeding the clay to the moulds, by ieans of the cut-off, in the hopper case, with the scraper, for heaping the clay under he plunger, in connexion with the plunger, operated as described, for partially conensing the clay into the moulds preparatory to pressing, substantially as described.

"I also claim the carrier, for clamping and removing the brick from the moulds, consisting of the clamp, and back plate, for clamping the brick, and the spring, and tumbler haft and trigger, or their equivalents, arranged substantially as described, and operated ipon by three stationary pins, substantially in the manner and for the purpose herein ully set forth."

---

4. For an *Improvement in Rotary Pumps;* Henry C. Spalding and Gage Stickney, Hartford, Connecticut, April 20.

Claim.—"Having thus described the nature and operation of our invention, what we

claim as new is, the spiral flanch, working within a circular case, said flanch being constructed as described, in combination with the sliding valve, the spiral flanch and valve, operating in the manner and for the purpose substantially as herein shown and specified."

---

45. For an *Improvement in Balance Gates;* William C. Van Hoesen, Leeds, New York, April 20.

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, the method of opening and closing the gate, substantially as herein shown and described, viz: by means of the ropes or cords passing over the semi or half pulley, and attached to the small upright, said pulley being attached to one of the side pieces, the gate being hung upon pivots, and balanced by the weight or counterpoise, the several parts being operated as set forth."

---

46. For an *Improvement in Tailors' Measures;* William T. Wells, Shelbyville, Tennessee, April 20.

Claim.—"What I claim as my invention is, the graduated straps, No. 1, No. 2, and No. 3, in connexion with the several centres about which they respectively turn, and with the graduated arcs, the said centres being arranged substantially as herein set forth, and for the purposes specified, using for that purpose the aforesaid instrument, or any other substantially the same, and which will produce the intended effect; but I disclaim having invented the tape measure or the elastic square, designated as No. 3, underneath the main instrument."

---

47. For an *Improvement in Hame Tugs;* R. B. Whipple, Cleveland, Ohio, April 20.

Claim.—"What I claim as my improvement is, the formation of the hame tug, by means of the two metallic plates, fitted together so as to embrace the buckle, loop, and cleft, substantially in the manner herein set forth."

---

48. For an *Improved Reflecting Spirit Level and Square;* Francis Wilbar, Roxbury, Massachusetts, April 20.

Claim.—"I would remark, however, that I deem the cubical block, with its two mirrors and two spirit levels, arranged as seen in the drawings, the most convenient form; and it is this instrument, or combination of block or frame, two mirrors, and two spirit levels, or what is equivalent to the two levels, viz: a spherical surface level, I claim as my invention."

---

49. For *Improved Devices for Casting Circle Plates, Roses, &c., with Dovetailed Grooves;* Nathan Matthews, Assignor to Richard Edwards, David A. Morris, and Nathan Matthews, Pittsburg, Pennsylvania, April 20.

Claim.—"What I claim as my invention is, forming the dovetails in circle plates by dovetail pieces, which are withdrawn lengthwise from the recesses, the said withdrawing being performed by attaching the dovetail pieces to levers, F F, within the cylinder, E, or body of the mould, the said levers being moved by a rod passing through the side of the cylinder or body of the mould, substantially as herein set forth."

---

50. For an *Improvement in Railroad Car Brakes;* Benjamin Kraft, Reading, Pennsylvania, April 20.

Claim.—"I do not claim the mere application of friction rollers, *e e*, as such are not new; nor yet do I claim, independent of the means and manner shown, the employment of a stop, to prevent the advance rubber from being raised by the wheel, or exclusively of itself, the adoption of a spring to reduce the shock. But what I do claim as my invention is, the combination and arrangement of the sliding bar, E, made as described and represented in fig. 1, with the rollers, *e f*, and suspended frame, B, attached to a hanger, C, by a centre pin, *i*, on which is adjusted the spiral spring, *d*, said frame being made, arranged, and operated in the manner and for the purpose herein set forth."

1. For *Improved Valves for Steam Engines;* Matthias W. Baldwin, Philadelphia, Pennsylvania, April 27.

"My invention and improvement consist in arranging in a suitable valve chest, a duplex lve, (one part of which is actuated by valve gear in the usual manner,) and its office is admit steam directly from the boiler, to actuate the other part, which opens and closes e passages, for steam to pass into or out of the cylinder."

Claim.—"What I claim as my invention is, the arrangement in the valve chest of a eam engine of a duplex valve, one part of which is actuated in the usual manner, by lve gear, to admit steam from the boiler to act directly on the other part, and force it to en and close the steam or exhaust passages, substantially as herein described."

. For an *Improvement in File Cutting Machinery;* John Cust Blair, Pittsburg, Pennsylvania, April 27.

Claim.—"Having thus fully described my invention for cutting files, I would state, that lo not claim a pattern for regulating the depth of the cut of the chisels; but I do claim e combination of the pattern, located between the cam and the chisel carriage, in the anner herein described, with said cam and carriage, and the file carriage, by which the ttern is moved; the whole arranged and operating substantially in manner and for the rpose set forth."

. For an *Improvement in Shuttles for Weaving Hair Cloth, &c.;* Daniel L. Dewey, Hartford, Connecticut, April 27.

Claim.—"What I claim as my invention is, the combination of the sliding bar with e springs, when used in connexion with stops attached to the shuttle boxes, or other nvenient fixtures, so that the motion of the shuttle will slide the bar in such a manner, at when one of the springs drops one piece of the woof or filling, the other spring will ceive and confine another at the other end, so that the pieces may be carried through ternately from each side, and released or dropped in the right position to be beat up, hen the whole is constructed, arranged, and combined, substantially as herein described."

. For an *Improvement in a Hold-Back for Sleds;* Perry Dickson, Blooming Valley, Pennsylvania, April 27.

Claim.—"I do not claim connecting the dogs with and operating them by the backward essure of the tongue; but I claim as my invention, as being more simple than the ordiry means by which this is effected, attaching the dogs to the roller rigidly, instead of to e runners as is usual, and connecting the tongue to the said roller by hinges or analous joints, in such a manner that the backward motion of the tongue, in relation to the dy of the sled, turns the roller on its axis, and forces the points of the dogs, so attached it, into the snow or ice of the road, substantially as and for the purpose herein set forth."

. For an *Improvement in Smut Machines;* John M. Earls, Troy, New York, April 27.

Claim.—"Thus having fully described my machine, I wish it to be understood that I not claim as new a "perforated case," the same having been heretofore in use; neither I claim a spike rubber; nor a ventilator with spiral arms; nor scourers made of sheet or er metal; nor do I claim the oil box at the top of the machine, nor the oil pipe for the ver bearing of the shaft. But what I do claim as new is, 1st, The projecting screen ambers, in combination with the arrangements for separating the rubbing chamber from fan chamber, whereby the grain is prevented from being affected by the blast from the chamber while it is passing through the rubbing chamber, and is only brought in cont with the current of air where it ascends to take away the chaff and other impurities, bstantially as herein set forth.

"2d, I also claim, in combination with the scouring surfaces, the beating forks, for the rpose of beating the grain and breaking the hulls, while falling from the rubber to the urers, whereby the berries are more effectually cleaned from adhering impurities, as rein set forth."

56. For an *Improvement in the Relief-Steering Apparatus;* Nathaniel T. Edson, New Orleans, Louisiana, April 27.

Claim.—"Having thus described the nature of my invention, the way in which it is constructed, and its operation, I do not claim any particular part of the apparatus as new; but what I claim as my invention is, the combination of the forked and unforked pawls with a single ratchet, and with rubbers placed face to face, and on the same side of the wheel.

"2d, I claim the combination of the spring, the arms, and the cap piece, with the relieving springs, whereby the pawls are supported with sufficient firmness, but at the same time permitted to have sufficient play to admit of the action of the said relieving springs, all as substantially set forth, represented, and described."

---

57. For an *Improvement in Railroad Switches;* John F. Klein, Trenton, New Jersey, April 27.

Claim.—"What I claim as my invention is, the bars or shifters, constructed, arranged, and connected to the switches of a railroad, in the manner and for the purpose substantially as described, so that if the train run in either direction, and the rudder be placed in either position, as described, and if the switch or switches are not in a proper position, the rudder will act upon the shifters and move them gradually as the train approaches, so as to move and place the switches in such a position that the train may pass on unimpeded, without the risk of running off the track."

---

58. For an *Improvement in Gins for Long Staples of Cotton;* Calvin Willey, Jr., Chicago, (now deceased,) Assignor to himself and Urial Walker, Babcock's Grove, Illinois, April 27.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, regulating the feed of a cotton gin for ginning Sea Island cotton, by means of an endless apron, which may be set to or from the feed rollers, to suit the quality of the staple, and the quantity to be fed in to be cleaned, and still be driven by the same mechanical movement, substantially as herein described.

"I also claim, in combination with the covered feed rollers which receive the material from the apron and carry it into the machine, the series of alternate brushes and elastic beaters on the same shaft, for combing out the fibre and knocking off the seed, whilst it is still held by said rollers, as herein substantially set forth and described.

"I also claim, in combination with the inclined chamber, through which the material is driven by the blast from the wings of the beaters, the inclined chamber having a cross blast through it from the fan blower, to complete the entire separation of the fibre and the seed, both chambers being provided with screens, substantially in the manner and for the purpose herein fully set forth and described."

---

59. For an *Improvement in Warm Air Furnaces;* Alexander Kelsey, Assignor to James Cowles, Rochester, New York, April 27.

"The nature of my invention consists in the employment of an equalizing flanch, so arranged that the air which enters the furnace on both sides of a radiating cylinder is warmed to about the same temperature, before entering the warm air conducting flues."

Claim.—"Having thus described the nature of my invention, and the manner in which it is constructed, what I claim as new is, the use of an equalizing flanch, with the tubes attached, by which the air on each side of the radiating cylinder is warmed to about the same temperature before entering the warm air conducting flues."

---

60. For an *Improvement in Machines for Pressing Tobacco;* Ephraim Parker, Rock Island, Illinois, Assignor to Alfred A. Parker, St. Louis, Missouri, April 27.

Claim.—"Having thus fully described the nature, construction, and operation of my improved tobacco press, what I claim therein as new is, the use of the revolving mould disk, combined with its revolving bed plate, with the scraper, and cloth roller, or their equivalents, for keeping the moulds free from the liquorice or juice of the tobacco, substantially as described.

"*I also claim* the use of revolving sinkers, constructed substantially as described, *combined with* the pan and cushion, or their equivalents, for keeping the same clean, and the

combination therewith of mechanism for moving the sinkers a quarter of a revolution at every eight, more or less, number of pressings, substantially as described.

"I also claim the conductor, formed of endless aprons or belts, or their equivalents, for confining and retaining the plugs under pressure, until they are thoroughly consolidated, in manner and for the purpose substantially set forth."

---

61. For a *Stud Brace for Flues of Sheet Water Space Boilers;* Andrew Lamb and William A. Summers, County of Hants, England, April 27; patented in England, December 9, 1848.

Claim.—"What we claim as our invention is, the stud brace, for bracing the flat surfaces of steam boilers, substantially as described in the foregoing."

---

62. For an *Improvement in Brushes;* Freeman Murrow, Williamsburgh, New York, April 27.

"Brushes constructed in the usual manner, with fixed and immovable handles, are inconvenient for many purposes for which they are needed; to remedy these defects, and to facilitate execution in the use of brushes, is the object of my invention; and it consists in so connecting the handle with the brush thereof, by means of a ball and socket, and sliding joints, that the brush can be adjusted to any desired position and angle with its handle."

Claim.—"Having thus fully described my invention for brushes for white-washing, varnishing, painting, washing painted cornice and walls, &c., &c., what I claim as my invention is, the double adjustability of the brush, by means of the combination of the ball and socket joint, and the sliding joint, or their equivalents, substantially as herein set forth."

---

63. For an *Improved Float Gauge Feed Regulator, &c., for Steam Boilers, &c.;* Thomas J. Sloan, City of New York, April 27.

Claim.—"I do not wish to be understood limiting myself to the construction and arrangement of parts herein above described, as these may be varied, without changing the principle or mode of operation of my invention.

"I am aware that a float placed within a boiler, or within a vessel communicating with a boiler, has been employed to regulate the position of ratchet hands, operated by an independent mechanism, to open and close a valve cock, or regulate the motion of a pump, the said float being employed simply to engage or disengage the said ratchet hands; but when so employed, the said float has been so arranged as to act on the said mechanism outside the boiler, &c., and hence, subjected to the difficulties above pointed out.

"I do not therefore claim, broadly, the employment of a float to regulate the action of an independent mechanism, as a means of indicating the height of water, and regulating the supply thereof, when such float acts upon such mechanism outside of the boiler; but what I do claim as my invention is, the employment, substantially as described, of an independent float, within a steam or other boiler or vessel, which, as its position is varied by the change of level of the water, shall act as a check or stop to the motion of a mechanism combined therewith, and operated by an independent motive force outside of and passing through to the inside of the boiler, substantially as described, to determine the supply of water to be given, or to give the required indication or alarm, as specified.

"And I also claim the method herein described, of preventing the action of the mechanism outside, which is actuated by an independent force, from reacting on and changing the position of the float, that it (the float) may be free to follow the varying level of the water, as specified."

---

64. For an *Improvement in a Self-Loading and Dumping Cart;* B. T. Stowell, Waddam's Grove, Illinois, April 27.

Claim.—"What I claim as my invention is, the manner of opening and closing the slatted bottom of the cart body, substantially as herein set forth, viz: by means of a bar, which is jointed to the rear edge of the foremost slat, and which, when its rear end is unfastened, descends vertically, and allows the whole series of slats to be opened simultaneously, by the action of the weight within the cart body pressing upon the same; and when the rear end of the said bar is drawn rearwards and upwards, simultaneously actuates the whole series of slats, and thereby closes the bottom of the cart body."

65. For an *Improved Steering Apparatus;* Alfred Swingle and Nehemiah Hunt, Boston, Massachusetts, April 27.

Claim.—"We are aware that the steering gear and rudder head have been connected together, and the tiller made to rise and fall with them; and therefore we do not claim such an arrangement: but what we do claim as our invention is, the construction and arrangement of the tiller and rudder head as described, in combination with steering gear, entirely separate from the rudder head; the tiller being connected with the latter and attached to the former in such manner, that when the rudder is unshipped, or raised unusually high, by striking the bottom, the tiller will be disconnected therefrom, without danger of breaking either the steering gear or the rudder head, or being itself broken."

66. For an *Improvement in Boxes for Journals;* Henry Turner, Charlestown, New Hampshire, April 27.

Claim.—"I claim making the cap box in the manner described, that is to say, of alternate pieces of hard and soft metal, arranged in a helical position, by which, together with the circular end pieces, the soft metal is kept in place, and friction and injury to the axle prevented, substantially as described."

RE-ISSUES FOR APRIL, 1852.

1. For an *Improvement in the Construction of Furnaces for Smelting Iron Ore;* J. Augustus Roth, Philadelphia, Pennsylvania; patented October 31, 1839; re-issued April 6, 1852.

Claim.—"Having described the construction and operation of my improved furnace for smelting ores and metals, I will now state what I claim as my invention and improvement. 1st, I do not claim the increasing of the draft as separately by itself. 2d, And I do not claim to generate steam, or to heat the blast by waste heat, otherwise than hereafter claimed.

"I therefore only claim as my invention and improvement, the arrangement of the five chambers, opening each by a flue into one horizontal flue, in combination with the boiler placed in said flue for generating steam, and the pipes therein, as a means of heating the blast; the whole being constructed and operating as described."

2. For an *Improvement in Washing Apparatus;* James T. King, Baltimore, Maryland; patented October 21, 1851; re-issued April 13, 1852.

Claim.—"Having thus fully described my invention, what I claim therein as new is, placing the rotary boiler for washing clothes immediately over the fire, and so combining with it a reservoir or top boiler, as that said rotary boiler shall form the lower half of the flue, whilst the said reservoir or boiler shall form the upper half of said flue, and from which the revolving boiler may be supplied with water, and thus greatly economize heat, substantially in the manner herein described and represented.

"I also claim, in combination with the rotary boiler and shielded stationary pipe, the top reservoir or boiler for receiving the excess of steam from the boiler, and heating the water therein; and this I claim, whether said reservoir is divided by partitions or not; the whole being arranged in the manner and for the purpose herein described."

3. For an *Improvement in Self-Detaching Brakes;* John Lahaye, Reading, Pennsylvania; patented April 10, 1847; re-issued April 13, 1852.

Claim.—"What I claim as my invention, in combination with the method of forcing the brakes against the wheels, by connecting the brakes, or the mechanism which works them with the bumpers or draw-bars, substantially as specified, is, the method, substantially as specified, of releasing the brakes, notwithstanding the continuance of the force by which they were applied, by the reversing action of the wheels on the brakes, to effect a disengagement of the pressing force, as described.

"As one of the devices for applying the principle of my invention, I also claim connecting, by means of a detachable catch or hook, substantially as specified, the bumper or *draw-bar*, with the lever, or its equivalent, which forces and holds the brake against the *wheels, substantially* as specified, so that, notwithstanding the continuance of the back-

pressure on the said bumper or draw-bar, the connexion can be readily broken, to the brake, and thus leave the wheel free to run, as specified.

nd I also claim making that part of the brake which acts directly on the wheel, separom, but so connected with, as to slide freely on the part which receives the action mechanism for forcing the brake against the wheel, substantially as described, by of which, on reversing the motion of the wheel, the one part of the brake in contact rith is made to slide, to give the required motion for effecting the disengagement, as specified."

Designs for April, 1852.

a *Design for Cooking Stoves;* Anthony J. Gallagher and John J. Baker, Philaelphia, Pennsylvania, April 20; ante dated January 7, 1852.

aim is to the application of the above design to cooking stoves.

r a *Design for Cooking Stoves;* John J. Savage, Assignor to Alexander Morrison nd Thomas M. Tibbitts, Troy, New York, April 13.

aim is to the configuration of and ornamenting the plates and panels of cooking, substantially the same as herein represented and set forth.

r a *Design for a Cooking Stove;* Samuel H. Sailor, Assignor to North, Harrison Chase, Philadelphia, Pennsylvania, April 27.

aim is to the design and configuration of the conical rods, series of converging angurs, central figure, and leg, as herein described, forming an ornamental design for a ig stove.

a *Design for a Portable Furnace;* James G. Abbott and Archilus Lawrence, Philadelphia, Pennsylvania, April 27.

aim is to the combination and arrangement of the ornaments herein represented and ed, making an ornamental design for a portable furnace.

MECHANICS, PHYSICS, AND CHEMISTRY.

Translated for the Journal of the Franklin Institute.

mary of a Series of Meteorological Observations made on the Pyrenees, ring the summers of 1848 *and* 1849; *on the Mountains of Provence, ring the summer of* 1850; *and on the French Alps, during the summer* 1851. *By* M. Rozet.

ie aqueous vapors which emanate continually from the surface of the , rise in the atmosphere, without being visible, at least generally, to ght proportional to the temperature of each place. As the temperafalls in proportion as the height increases, these vapors finally come a region where they are compelled to pass from the invisible to the le condition. When the air is calm and the heavens serene, this reis marked by a light haze, like a gauze, terminated above by a horiil surface. The observer sees this terminal surface perfectly when ands at the same elevation with it, or a little above or below it. n he is at a certain height above it, he sees it forming around the on a narrow band constituting an immense ring, of which he occuthe centre.

is on the level of this terminal surface of the ocean of vapors that umulus clouds generally originate. Limited by it below, they rise

above it to variable heights in mammillary masses, and terminate above in irregular curved surfaces. When these clouds do not touch each other, the interstices which separate them are seen at the level of their bases, occupied by a light fog which connects them together.

The height of the terminal surface of the ocean of vapors varies with the temperature; being at its minimum about sunrise, it attains its maximum about 2 o'clock afternoon, then sinks again until the next morning. The summits covered with snow determining around them a region colder than the zone of the atmosphere which is at their level, the portion of the terminal surface of the vapors which passes above them bends towards them, as the clouds on this surface come and attach themselves to the mountain. At the level of this surface I have always found the temperature above 0°. (32° Fahr.) In the Pyrenees, the maximum of altitude was 2200 metres, in the Alps I have known it to attain 3200 metres.

In the valleys, peculiar circumstances, such as the presence of snow, winds from the north sweeping their flanks, shadows thrown by high crests, &c., determine cold regions, in which the vapors coming from the soil are forced to pass into the visible state far below the level at which this happens for the country in general. Then there is seen to form in these regions a horizontal mist covering the valleys, and often afterwards strata of cumulus lower than the general mass, which at the same moment is higher than the summits of the mountains overlooking the flanks of the valleys.

In the Alps, the height of the upper surface of the cumulus often exceeds 4000 metres, (4376 yards,) of which I have been able to assure myself by referring it to the summit of Pelvou, which rises to 4100 metres (4485·4 yards) above the level of the sea. It is above this surface, and often at more than 2000 metres (2188 yards) above it, according to my estimation, that the region of the *cirrus* begins. These clouds, which the observation of halos and the aerostatic ascent of MM. Barral and Bixio (*Journ. Frank. Inst., Vol.* xxi. 3*d series, p.* 34) have shewn to be composed of very small crystals of ice, must, from the aspect of their lower surfaces, which are arranged like that of the cumulus on an immense spherical vault, occupy a region terminated below by a horizontal surface.

In calm weather, these two strata of clouds of different nature exist together without mingling. All the clouds of each stratum are in the same electric state; they are seen to approach, even to touch each other, without giving rise to the slightest electrical discharge. But the strata themselves are generally in opposite electrical states; for when, in bad weather, the clouds of each meet each other, the approach and contact are marked by greater or smaller electrical discharges.

It is from the mingling of the clouds of these two strata that storms, rain, and snow result. Then the cirrus is seen to descend, and the cumulus to rise, stretching itself out into columns, and the contact is immediately announced by the formation of a *nimbus*, in the vicinity and in the midst of which the electric discharges are seen when they take place. Often in summer, in autumn, and almost always in winter, the nimbus forms without the least appearance of electric discharges. This proves that the electricity which is developed during storms is one of their results and not the cause.

I have seen in the high mountains, heavy bodies of cumulus, hiding the sun from the country below them, exist above for several days together without giving rise to the slightest storm, nor to the least rain. I have made the same remark as to the strata of cirrus, with this difference, that this kind of clouds, which have but little thickness and rarely touch each other, allow a part of the sun's rays to pass.

When the cirrus and cumulus exist simultaneously, without touching each other, neither storm nor rain is produced; it is only at the points where the junction takes place that these phenomena shew themselves. This is the precise reason why it does not always rain at the same time at all points covered by a stratum of cumulus.

This year, in the Alps, I have frequently had occasion to establish the fact that it always snows in the region in which the meeting of the cirrus and cumulus takes place. The elevation of this snowy region varies with the temperature of the air, or, what amounts to the same thing, with the height of the stratum of cumulus. I have established this fact by observation on high points, whose elevation I had geodetically determined, on which snow fell while it rained on the plains and in the valleys below. Having at the same time observed the thermometer, I found that this summer, in the High Alps, whilst it rained in the valleys, at a height of 800 metres, (875·2 yards,) the thermometer being at—

+5°	Cent.,	it snowed down to		900	metres,	984·60	yards.
7	"	"	"	1000	"	1094·00	"
8–9	"	"	"	1200	"	1312·80	"
10	"	"	"	1500	"	1641·00	"
12	"	"	"	1700	"	1859·80	"
14	"	"	"	2000	"	2188·00	"
16	"	"	"	3000	"	3282·00	"

Having been three times so situated that I could easily pass from the region of snow to that of rain, I found that the rain in large drops came from flakes of snow, while the rain in small drops, which is generally colder than the other, comes from small grains of snow. In the snowy *nimbus clouds*, the thermometer stood at +2° (35·6° Fah.) in those giving flakes, and at +1° or +1·5° (33·8° or 34·7° Fah.) in those having the snow in small grains.

During three months I made a series of barometric observations, for the purpose of learning how the mercurial column varies at the approach of bad weather, during, and after it, which series led me to the following results:

The mercury begins to fall when cirrus and cumulus shew themselves in the atmosphere at the same time; the fall is greatest at the time of the formation of the nimbus. When the rain lasts only a few hours, the barometer remains stationary, and immediately afterwards rises sensibly, at the same time that the nimbus rises, passing into cumulus. When the rain has lasted several days together, I have seen the barometer fall and rise several times, without being able to connect its movements with those which were then going on in the clouds.

When in high regions the cirrus approach the cumulus, bringing with them a very low temperature, the thermometer falls suddenly several degrees, and the cold which results is very sensible, although in the place where the meeting takes place, I have never seen the thermometer descend below 0° (32° Fah.) This is the explanation of the sudden cold

which storms and rain bring with them. All my observations taken together, go to prove that all the aqueous meteors of the atmosphere have for causes, solely, variations of temperature, and that the development of electricity which often accompanies them, is simply a result of the approach and meeting of clouds of different kinds.

A great number of hypotheses have been formed to explain the formation of rain and storms. Hutton said, "The rain results from the mixture of two masses of air saturated with moisture, but of unequal temperatures." I have, while on a mountain, caused a mass of vapor, obtained by throwing snow on burning charcoal, to pass through a cumulus whose temperature was below 5°, (41·9° Fah.,) and no precipitation resulted. The artificial vapor soon disappeared by mixing itself with the other, whose temperature it did not sensibly increase. On railroads during fogs, I have often had opportunities of seeing that the steam coming from the chimney of the locomotive disappeared in the midst of the fog without giving rise to the slightest rain.

It is not possible, moreover, to account for the formation of the rain, and the principal phenomena which accompany it, by the rising of the clouds into a region where low temperature would precipitate the vapor; in the high regions of the atmosphere the vapor is in a frozen condition; when the temperature of the region in which the cumulus are situated lowers, they immediately descend, without any precipitation, to a point at which the temperature of the air is high enough to allow them to exist tranquilly. This fact may be established by a single day's observations on high mountains. During four years of observations on high mountains, I have never seen true rain form except by the mingling of cirrus with cumulus, that is, of frozen with vesicular vapor.

---

*Hollow Bricks.**

"There is nothing new under the sun," was the observation of Solomon. If you remember, it was stated that it was intended by the Bey to send over specimens of hollow bricks, at the present time in constant requisition in Tunis, for the Great Exhibition; but the interest of such a contribution was at the last moment accidentally overlooked.

In the Museum of the Bath Scientific Institution, specimens of hollow bricks used by the Romans, and dug up within a short distance of the spot where they are now deposited, may be seen by any party interested. They are double the size of those used by Messrs. Bazely & Co., and are cemented together by *genuine Roman cement.* And, no doubt, a machine like our modern ones for making them was also used by the Romans. It would be interesting to test the strength of these bricks, and of the cement that unites them, as compared with the modern manufacture. In Bengal, the floors of Bungalows are usually constructed with earthenware pots, commonly called "Kedgeree pots," turned over, with their orifices on the ground. Charcoal is filled between the interstices, and a coat of brick concrete is laid on the top, thus forming a perfectly dry floor. What a comfort would floors of hollow brick prove to the kitchens or cellars in some of our damp localities! H. W.

* From the London Builder, No. 469.

Extracts from the Engineer's Report to the Trustees of the Philadelphia Gas Works, in their 17th Annual Report, January, 1852.

The manufacturing department exhibits a moderate increase in the ıantity of gas produced, and has fully maintained its usual character for ırity and illuminating value. The gas made in the year is two hundred illions, eight hundred and forty-two thousand cubic feet, which added the previous production, make the whole quantity yielded by the 'orks, eleven hundred and ninety-eight millions, seven hundred and one ousand cubic feet. The consumption of the different Districts is as llows:

To the District of Spring Garden, 7,039,800 cubic feet; to Southwark, ,279,000 cubic feet; to Moyamensing, 1,254,700 cubic feet; and to the ity proper, 181,638,825 cubic feet; leaving as the amount used in the 'orks and lost by leakage, 5,629,675 cubic feet, or rather more than 2¼ er cent. of the quantity made. This item has been somewhat increased is year by several incidents of unusual character. On two occasions ains in the street were broken by the caving of cellar vaults extending nder the street, and the gas escaped in large quantity for several hours, efore notice of the accident reached the Works. Another main was milarly fractured by the sinking of a culvert, and a considerable number f service pipes of the largest size was broken at the extensive fires in 'hesnut street, at Sixth and Seventh streets, and continued to waste gas r several days before they could be reached through the burning ruins.

* * * * *

The varieties of coal used in any considerable quantity are those obained from Pittsburg, Pa., Richmond, Va., English Newcastle, English 'annel, and a new article from New Brunswick, in British North America, hich is used as a substitute for rosin when the coals are not rich enough n bitumen.

* * * * * *

In accordance with the desire of the Committee on Police, the distriution has been so conducted as to place a pipe for the supply of public amps in nearly every street, lane, and alley east of Schuylkill Third treet; the few that remain unsupplied will be completed early in the pring, and a large proportion of those situated west of that line, will be imilarly furnished in the course of this year.

The length of pipes thus laid is 42,141 lineal feet, chiefly of two, three, nd four inch calibre, with a few six inch and eight inch, making with hose previously laid, an aggregate length of 542,408 feet, or 102¾ miles.

The increase of services, meters, and burners within the City, is greater ıan in any previous year, nearly compensating for the withdrawal of the ntire number in the District of Spring Garden, so that the number of ights supplied is but 1600 less than those in use a year ago, including hose in that populous district.

The new meters and service pipes added are 1211, the whole number n use being 10,449.

The applications registered are 2529, removals and discontinuances

1339; the increase being 1190, with 21,616 additional lights, besides 124 new lamps in the streets.

The entire number of City customers on the books on the 31st of December, was 10,406, using 136,620 lights; the public lamps are 1588 in the streets, 50 in market houses, and 62 in public squares. The Districts of Southwark and Moyamensing report 4943 private and 178 public lights, making a total of 143,441 supplied by these Works.

* * * * *

The effect in economizing labor and materials is made very evident, by comparing the lime accounts of the last three years. Thus in 1849, 135,000,000 feet of gas required for purification 129,048 bushels of shell lime; in 1850, when the first series of enlarged purifiers was used, 182,000,000 feet were purified with 111,668 bushels, and in the past year, with two such enlarged series in operation, 200,000,000 feet have been purified with only 64,545 bushels. Should there be no very great increase of make of gas this year, it is probable that by the addition of the last and largest series, the quantity of lime may be reduced below 50,000 bushels.

Some experiments have also been made during the year, with a view to ascertain the value of several schemes for the manufacture and use of gas, that have recently claimed a share of public attention, both in this country and in Europe.

Among them are the so-called hydro-carbon gas, made from steam in combination with various hydro-carbonaceous materials, patented here and in England, by Mr. White; the gas from asphaltum or other highly bituminous substances recommended by Dr. Gessner; and the pure hydrogen light with platinum wick, put in operation by M. Gillard, in Paris. These schemes do not bear upon their face the evidence of absurdity or impracticability, such as attaches to the famous project of electric light at almost no cost, so much agitated a year or two back; but the results of our experiments are not such as to lead to the belief that any advantage would be derived, at present, by adopting them upon an extensive scale. The proper course with respect to them will be to keep them in view, by following up experimentally all their modifications and improvements, of which some that are of practical importance have already been suggested, so as to be prepared to substitute them for the present methods, as soon as such course may be rendered advantageous, either by the perfection of the new plans, or some commercial revolution affecting the value of the materials or products of the different processes of manufacture.

The only other experimental operations of the year of which mention need be made, were those connected with the ignition of the large body of Virginia coals already adverted to.

This ignition, which was undoubtedly of spontaneous origin, being for some time confined to the central and inaccessible parts of the mass, commenced early in the autumn, and spread very much through the interior of the heap before it became evident at the surface, by any other symptom than the peculiar benzoic odor that invariably accompanies this species of decomposition. As soon as the existence and locality of the ignition was discovered, attempts were made to check it, by the effusion of carbonic acid gas generated by the combustion of coke in an air-tight furnace, sup-

d with air by means of a fan-blower. Large volumes of the gas were wn upon the heap, and were also forced into the interior, through ks and pipes of large calibre, the effect of which was to extinguish few moments every appearance of conflagration and active combus-, but it did not seem to influence materially the tendency to slow omposition, by which great waste of the useful constituents of the is produced, and the fires rekindled on the withdrawal of the me-ic gas.

fter repeated trials of this process, made through several weeks, it ame evident that the entire destruction of the coals could be prevent-nly by their removal and speedy use, for which purpose the carbonic had to be discontinued, and the coals flooded with water.

Report on Analysis of Gas.

Philadelphia, January 6th, 1852.

s C. Cresson, Esq., Engineer, &c.

ir:—We have the honor herewith to communicate the results of ob-ations recently made by us at your request, upon the comparative minating powers of Gas used in New York and Philadelphia respec ly.

he following table shows the observations actually made:

o.	Denomination.	Press're at Burner	Time.	Interval.	Meter Reading.	Quantity.	Cubic ft. per hour.	Mean cons'n per hour.	Tests.	Photometric Distance.	
										Gas burner.	Candle.
		in.	h. m.	m	d.			c. f.			in.
2.	Manhattan Gas.	0·4	2·12		20·0				No. 1	37·125	10
			·19	7	44·0	24·0	3·429		2	37·5625	"
			·32	13	90·5	46·5	3·577	3·5020	3	37·375	"
I.	Fish-tail Burner.		·37	5	108·0	17·5	3·500		4	37·5625	"
									White	37·9375	"
									" F.	38·	"
									Mean	37·69375	"
3.	Manhattan Gas.	0·2–0·25	9·42		8·5				No. 1	45·125	"
	Argand Burner.		·49	6	40·0	31·5	5·250		2	45·	"
II.	With conical deflector and swelled glass chimney, 7·5 in. high.								3	44·875	"
									4	44·575	"
			·55	6	71·0	31·0	5·167	5·2080	White	44·625	"
									Mean	44·9	"
5.	Philadelphia Gas.	0·4	11·18		25·9				No. 1	46·75	"
			·30	12	86·4	60·5	6·041–6		2	47·	"
III.	Fish-tail burner.		11·54		23·0			6·0375	3	46·625	"
			12·00	6	53·2	30·2	6·031–3		4	46·9375	"
									White	46·625	"
									Mean	46·5875	"
6.	Philadelphia Gas.	0·225	0·11		18·5				No. 1	43·	"
			0·16	5	44·5	26·0	5·200		2	43·75	"
IV.	Argand Burner, as before.		·38		8·0			5·1600	3	42·875	"
			·43	5	33·6	25·6	5·120		4	42·75	"
									White	42·875	"
									Mean	43·05	"
6.	Philadelphia Gas.	0·275	0·46		15·5				White	F. 47·625	"
	Argand Burner.		0·51	5	52·0	36·5		6·0830	"	A. 47·5	"
V.	Normal illumination.								Mean	47·5625	"

The observations in New York were made during day-time, but in a chamber utterly darkened; the tinting of whose walls and furniture was more favorable for experiment than was the case in Philadelphia.

The pressure-gauge was filled with Croton water in New York, and Schuylkill water in Philadelphia. As the absolute quantities consumed were otherwise directly ascertained, the record of the circumstance is of no further interest than as showing that the gases burned were of equal elasticities, respectively. The meter used was a small one, each of whose divisions corresponded with the $\frac{1}{80}$th of a cubic foot; the ratio of these divisions to minutes of time, is of course equivalent to that of cubic feet per hour, as given in the 8th and 9th columns. The readings of this in Philadelphia, were in fact made from minute to minute, at the beginning and end of each experiment, through the respective intervals. The grouping used in the table for convenience gives a mean result, very slightly differing (in the third decimal place) in excess from the average of the individual intervals.

The tests used were tissue papers of different colors as follows: Nos. 1 and 2 were different shades of red, or properly pink, No. 2 being the lighter; No. 3 was a light yellow or citron; No. 4 a sea green. The other was a white laid paper, of uniform texture and thickness.

The gas burners are indicated in the table. In New York, the pressure with the argand was all that could be obtained; the stop-cock being entirely open, and the burner doing its best. In Philadelphia, where a higher pressure was attainable, the stop-cock had to be more than one-third closed; and the burner was not giving its best flame. Therefore, the fifth experiment was made under circumstances differing as to pressure, but affording, as we consider, the properest practical comparison.

The candle was one of Judd's patent sperm. sixes. There was no opportunity for weighing the actual consumption of it in New York, and therefore it was not weighed in Philadelphia. The results, then, are still affected by a possible want of uniformity in this respect. Otherwise all pains were taken to keep its flame at a maximum state of illumination, with a wick of constant length, and with the same side turned always to the photometer.

This was of Ritchie's arrangement, where two glass mirrors, oppositely inclined at 45° to the horizon, reflect the light received at either end of the oblong chamber in which they lie, vertically upwards to a common orifice. We were reliably assured that the mirrors had been reversed, and no appreciable difference recognised between them. We did not, therefore, repeat the experiment by turning it end for end, but used it always in the same position, with the candle, as shown, at a constant distance from the apex of the mirrors; from which also the distance of the gas light was measured.

The numerical deductions from the observations are exhibited in the following table:

Actual Distances.		Ratio of Squares.					
andle.	Gas Burner.	Candle	Number of Candles equal to 1 Gas light.	Consumption of Gas per hour.	Illuminative Power.	Ratio of Illumination.	Kinds of Gas and Burner.
in.	in.			c. f.			
10	37·59375	1 :	14·133 ÷	3·502 =	4·036	0·93	Exp. I. N. Y. Fish-tail.
10	44·9	1 :	20·160 ÷	5·208 =	3·871	0·89	" II. " Argand.
10	46·5875	1 :	21·704 ÷	5·0375 =	4·528	1·	" III. Phila. Fish-tail.
10	43·05	1 :	18·533 ÷	5·160 =	3·592	0·83	" IV. " Argand.
10	47·5625	1 :	22·622 ÷	6·083 =	3·719	0·86	" V. " do. No. 2.

These ratios of illuminative power may be combined in various ways r a conclusive result, according to whichever burner and state of presre may be considered as the fairest practical index. If the fish-tail ırner and the greatest density be so regarded, as we are inclined to do, en the Philadelphia gas is at least 7 per cent. more illuminative, with ual quantities in equal times, than the Manhattan.

The following statements show the other results, thus:

	Philad'a.		Manhattan, N. Y.
Fish-tail burner, .	1·	:	0·93
Argand, equal pressure,	0·83	:	0·89
	0·83	:	0·8277 :: 1 : ·9972

New York Manhattan gas ¼ per cent. worse than Philadelphia.

Again,

	Philad'a.		Manhattan, N. Y.
Fish-tail burner, .	1·	:	0·93
Argand burner, best flame,	0·86	:	0·89
	1·	:	0·9625

e. New York Manhattan gas 3¾ per cent. worse than Philadelphia.

Finally,

	Philad'a.		Manhattan, N. Y.
Fish-tail burner, .	1·	:	0·93
Argand, average, .	0·845	:	0·89
	1·	:	0·9795

e. New York Manhattan gas 2 per cent. worse than Philadelphia.

The diversity of these results serves to show, what was otherwise to ve been expected, that any and every illuminating gas, according to its emical constitution and the pressure under which it is stored and deered, requires a burner of a particular form and size to develope its lest efficiency; in other words, that every gas wants its own burner.

In the present instance, the fish-tail burner used seems to leave very le to be desired for the Philadelphia gas; and the numerical results uld undoubtedly have been different, had the New York gas been tried th its best adapted burner: but this would have required a series of

observations and trials which we were not authorized in making; and, besides, the fish-tail and the argand seem to us to embrace the two limiting modes of burning between which the maximum effect must be found.

In this aspect the last result, which covers to all probable variations of management or mismanagement in the ordinary use of gas, appears to us worthy of undoubted acceptation.

J. H. ALEXANDER,
JOHN F. FRAZER.

REPORT ON THE ANALYTICAL INVESTIGATION OF THE ILLUMINATING GASES OF NEW YORK AND PHILADELPHIA.

The New York gas was taken from the office of Messrs. Spies, Christ & Co., corner of Broad and Beaver streets, in glass tubes drawn out to fine points, in which it was sealed by the blow-pipe flame, after a sufficient amount of the gas had passed through to insure the total expulsion of atmospheric air. The Philadelphia gas was taken at the Laboratory in College Avenue, Tenth street, between Market and Chesnut streets. The results prove them both to have been free of atmospheric air.

The course of analysis pursued was that of Prof. Bunsen, a description of which will be found in the *Journal of the Franklin Institute* for 1849. The results are given in volumes as the determinations were made, the reductions being in every case to the usual standards of England and the United States, viz: to 32° Fahr. and 30″ Barom. The thermometer was an accurate one of German manufacture. The barometer was a French aneroid, which had been previously compared with an ordinary mercurial barometer, and which would indicate the ·01 inch.

The following are the results of the analysis of 100 volumes of the two gases:

		New York Gas.	Philadelphia Gas.
Olefiant Gas	CH,	8·32	6·38
Marsh Gas	CH^2,	32·92	54·84
Hydrogen	H,	24·04	26·27
Carbonic Oxide	CO,	11·60	4·42
Carbonic Acid	CO^2,	2·10	0·97
Oxygen	O,	0·19	0·04
Nitrogen	N,	20·83	7·08
		100·00	100·00

JAMES C. BOOTH,
Prof. App. Chem. Univ. Pa.
WILLIAM L. FABER,
Philad., Dec. 30, 1851. *Pract Chem. & Metallurgist.*

ANALYSIS OF ILLUMINATING GAS, FURNISHED FOR CONSUMPTION IN NEW YORK AND IN PHILADELPHIA, AND COMPARISON OF ITS PROBABLE CHEMICAL CONSTITUTION IN THE TWO CITIES RESPECTIVELY.

The sample of New York gas was collected at the New York Hotel in the forenoon of 2d January, 1852, by J. H. Alexander, and understood to be furnished there by the Manhattan Gas Company; the sample of Philadelphia gas is believed to have been gathered in the forenoon of 1st January, 1852, by Professor Booth, from a burner in his Laboratory.

Direct measurements, corrected for a uniform barometer-stand of 30 in. and constant temperature of 32° F., gave the following results:

		Manhattan Gas.	Philadelphia Gas.
Carbonic Acid	CO^2,	0·0222	0·0087
Hydro-Carbons,	CH?,	0·0928	0·0996
Olefiant Gas	C^2H^2,	0·0344	0·0204
Lt. Carburetted Hydrogen	CH^2,	0·7089	0·3227
Hydrogen	H,		0·4049
Nitrogen	N,	0·1231	0·1461
		0·9814	1·0024

Assuming a constitution in accordance with the formulæ given above, these results may be reduced for comparison as follows:

	Manhattan.		Philadelphia.	
	Volume.	Weight.	Volume.	Weight.
CO^2,	0·0227 =	0·0777	0·0087 =	0·0306
CH,	0·0945 =	0·1044	0·0993 =	0·1129
C^2H^2,	0·0350 =	0·0774	0·0204 =	0·0464
CH^2,	0·3204 =	0·4035	0·3220 =	0·4172
H,	0·4020 =	0·0623	0·4039 =	0·0645
N,	0·1254 =	0·2747	0·1457 =	0·3284
	1·	1·	1·	1·
Corresponding spec. grav.,		0·444		0·432

The quantities inscribed as hydro-carbons were among the volumes absorbed by chlorine water in the dark; and no doubt appear slightly in excess from the vapor of naphtha accompanying the potassium used as one of the re-agents. The sample on hand was not sufficient to allow a repetition of the experiment by which this source of error might have been eliminated; but as both samples were purposely treated alike, it is fair to consider its influence as proportionate in the two cases, and as therefore not affecting the comparison here.

The smallness of the sample of Manhattan gas also gave no opportunity for separating the proportions of light carburetted hydrogen and pure hydrogen in that instance, as was done in the case of the Philadelphia gas. In the comparison, therefore, they are distinguished in the same ratio for the former as was found experimentally for the latter.

And the same obstacle prevented the experimental determination of specific gravities. The values given for this term above, are therefore only theoretical, and have been presented merely in illustration; though they may be presumed not to deviate materially from the fact.

Finally, if abstraction be made of the nitrogen and the carbonic acid, the former of which certainly and the latter probably contribute nothing to the illuminating power in combustion, the economical efficiency of the two samples may be compared in the ratio of their aggregated combustible elements, as under:

	Carbon.	Hydrogen.
Manhattan gas,	0·45845 = 1·	0·18915 = 1·
Philadelphia gas,	0·44944 = 0·98	0·19156 = 1·01

This last comparison shows the Manhattan gas to be richer in carbon by 2 per cent. and poorer in hydrogen by 1 per cent., under equal weights, than the Philadelphia gas; and implies besides, that under low pressures at the burner, the Manhattan gas should have the advantage in illuminating power, while under high pressures this advantage would be exhibited by the Philadelphia gas; and, finally, that within this range there is a point of pressure at which the illuminating power of the two gases, with the same burner, would be found exactly the same.

DAVID STEWART,
J. H. ALEXANDER.

Baltimore, February 16th, 1852.

NOTE.—A later analysis of the Philadelphia gas, made by Dr. CHARLES M. WETHERILL in the month of February, gives the following result:

Olefiant gas and Hydro-carbon vapors,	8·936
Oxygen,	0·136
Hydrogen,	44·168
Light Carburetted Hydrogen,	41·620
Carbonic Oxide,	5·081
Carbonic Acid,	0·000
Nitrogen,	0·059
	100·000

*Potash Salts in Soot from Blast Iron Furnaces.**

At the Glasgow Philosophical Society, on Wednesday, Dr. Penny communicated his discovery of the presence of a considerable quantity of potash salts in the soot from blast iron furnaces. The soot experimented upon was obtained from the Coltness Iron Works, where it collects in the flues that lead the heated gases, and other products of combustion, from the top of the furnaces to the air heaters and steam boilers. Dr. Penny gave the particulars of a careful analysis of the soot, and exhibited specimens of the potash salt, which had been extracted in large quantities by Dr. Quinlan, of Hurlet. The salt has been pronounced by competent judges to be a good marketable article, consisting chiefly of carbonate and sulphate of potash, with a small admixture of soda salts. According to the results of experiments described by Dr. Penny, it appears that the soot will yield about 50 per cent. of this marketable salt, containing 43 per cent. of pure potash. It has been found that the amount of potash in soot procured from other iron works is subject to variation, arising, no doubt, from the use of different coals in the blast furnace. From the well known value of potash salts, there is every reason to expect that this discovery will prove of considerable importance to those who are interested in these commercial products, and also to ironmasters, who will be enabled to turn to account a substance which has not hitherto been applied to any practical use.

*From the London Mining Journal, No. 847.

For the Journal of the Franklin Institute.

erformance of the U. S. Screw Steamship "San Jacinto," from Norfolk, Va., to Cadiz, Spain, during the month of March, 1852. By Chief Engineer, B. F. Isherwood, U. S. Navy.

The readers of the Journal are already acquainted with the dimensions ' the *San Jacinto*, and with the unusual proportions of her screw proeller, as well as with its results during the few trials which have been ade, and which were made under very unfavorable circumstances. An ccount, therefore, of her further performance will be acceptable.

On the 3d of March, 1852, at 6 A. M., the *San Jacinto* left Norfolk, a., for the Mediterranean, using steam when the wind was ahead, (about alf the time,) up to March 8th, midnight, when the forward bell crank ' the starboard engine broke in the neck of the spade handle. The time nder steam up to this period was 60 hours; the screw performing under e unfavorable circumstances of head winds and sea, assisted, but in a ery small degree, by the sails. The results tabulated from the steam log e as follows:

Date—March, 1852.	Number of hours.	Revolutions of screw and double strokes of engines per minute.	Steam pressure in boiler above atmosphere, in pounds pr. sq. in.	Vacuum in condenser per gauge in inches of mercury.	Throttle open.	Portion of stroke of piston, steam cut off at.	Speed of vessel per hour in knots of 6140 feet.	Cumberland bituminous coal consumed per hour in pounds.	Slip of the screw in per cents of its speed.	Wind, Sea, and Sail.
3,	18	25·2	11·7	24¼	5/16	½	7·50	2146	28·34	Head wind; no sail set.
4,	18	25·4	12·0	24½	"	"	7·00	2266	33·64	Heavy head wind; no sail set.
"	[illegible]	25·4	12·0	24⅓	"	"	7·75	2266	26·53	Light head wind; fore and aft sail set.
5,	8	24·5	11·5	23¾	"	"	9·00	2039	21·36	Strong wind and heavy sea forward the beam; fore and aft sail set, and close reefed foretopsail.
6,	4	25·0	12·0	24½	"	"	7·50	1974	27·76	Head wind; no sail set.
7,	9	25·0	11·7	23·4	"	"	6·75	2091	35·00	Strong wind and heavy sea ahead.
8,	8	24·5	11·8	23·6	"	"	9·60	2389	6·63	Strong wind and heavy sea abeam; ship rolling heavily; single reefed fore and main topsail set.
Means,		25·00	11·8	24	5/16	½	7·58	2177	27·17	Strong head wind and sea; small amount of sail braced on the wind, used for three-tenths of the time.

The *slips* in the above table are calculated for the mean (42½ feet) tch of the screw; and it will be at once observed how greatly a small ount of sail, and that on the wind, diminished the slip, showing how uch the head winds retarded the speed; for the diminution of slip was ore owing to the shifting of the wind from ahead around to a point here the sharply braced sail would draw, than to the effect of that sail.

Another point that will attract attention is, the manner in which the steam was used. The boilers are braced to sustain a working pressure of 30 pounds per square inch, and the cut-off or expansion valve is Sickel's, momentarily adjustable. The most economical manner, therefore, of using the fuel, would have been to carry say 20 pounds of steam in boiler per square inch above atmosphere, cutting off at one-fourth the stroke from the commencement, with the throttle wide open. Instead of that, the steam was used of a pressure of 11·8 pounds only, cutting off at half stroke, being also wire-drawn at the cylinder by a throttle $\frac{5}{18}$ths open. There was likewise a wretched vacuum of only 24 inches of mercury, instead of 27 inches.

From indicator diagrams taken during the trial trip, it appears that closing the throttle to $\frac{4}{18}$ths, caused a difference of $5\frac{1}{2}$ pounds between the boiler pressure and cylinder initial pressure, the engines then making 31 double strokes of piston per minute. Applying the same deduction now, with the throttle $\frac{5}{18}$ths open, and the double strokes 25·06 per minute, the total initial cylinder pressure would be (11·8 — 5·5 + 14·7) 21 pounds, and the mean total pressure throughout the stroke, including effect of steam in nozzles and clearance, would be 18 pounds: allowing the mean back pressure in the cylinders to be 2 pounds greater than in the condensers, the mean effective pressure throughout the stroke would be 13·3 pounds per square inch. The horses power developed by the engine would therefore be

$$\frac{3067{\cdot}96 \times 13{\cdot}3 \times 208{\cdot}83 \times 2}{33000} = 514{\cdot}8.$$

If, however, by better management, the steam were properly used as above suggested, the result would be as follows: Suppose the boiler pressure to be 20 pounds per square inch, and the initial cylinder pressure 18·3 pounds, cut off at one-fourth stroke from commencement, the mean total pressure throughout the stroke, allowing for effect of steam in nozzles and clearance, would then be 20 pounds; and with a condenser vacuum of 27 inches, and a cylinder back pressure greater than this by 2 pounds, as before, the mean effective pressure throughout the stroke would be 16·8 pounds per square inch of piston; and as the double strokes of piston with the same load, are in the proportion of the square roots of the pressures on it, they would become ($\sqrt{13{\cdot}3} : \sqrt{16{\cdot}8} : 25{\cdot}06$) 28·167; and the speed of the vessel being proportional to the double strokes of piston, would then become 8·52, instead of 7·58 knots.

The comparative quantities of fuel consumed in the two cases would be as follows: In the one case, cutting off at half stroke, there would be used per stroke, including amount in nozzles and clearance, 189·5 cubic feet of steam of the total pressure of 21 pounds, and making 25·06 double strokes per minute. In the second case, there would be used per stroke, including same amount in nozzles and clearance, 101·2 cubic feet of steam of the total pressure of 33 pounds, and making 28·167 double strokes of piston. Allowing the advantage of using steam under a higher temperature (growing from the facts that a less proportional amount of water is evaporated to produce it, and that the fuels required are in pro-

to the water evaporated only,) to be balanced by the greater loss tion, we have for the comparison,

$$21 \times 189{\cdot}5 \times 26{\cdot}060 = 103705{\cdot}77, \text{ or } 1{\cdot}120,$$
$$33 \times 101{\cdot}2 \times 28{\cdot}167 = \ \ 94065{\cdot}40, \text{ or } 1{\cdot}000,$$

consumption of fuel, which in the first case is 2177 pounds of r hour, would in the second case become $\left(\frac{2177}{1{\cdot}12}\right)$ 1944 lbs. per r 20·8 tons per 24 hours, giving a speed at deep draft of 8½ knots a strong wind and sea.

ng, however, to their complexity, and the faulty manner in which gines were designed, it is not at all probable that they could with- he pressure contemplated, and for which the boilers were intended ld be used. The engines were intended for 36 double strokes of per minute, to drive a screw of 37 feet mean pitch; but the Chief er of the *San Jacinto*, (who designed the engines,) apparently con- of their faulty and weak character, limited the double strokes of o 25, carrying low steam, and following far with it. The result r inferior performance to what might have been obtained from the screw, with strong and efficient engines of the present size.

ill, nevertheless, be satisfactory to compare the actual performance *San Jacinto* with the performance of the *Saranac*, (a sister vessel same size and built from the same lines,) under nearly the same stances. The following is all that is found recorded in the logs of rformance in heavy weather:

SARANAC.

Date.	Number of hours.	Double strokes of engines per minute.	Steam pressure in boiler above atmosphere, in pounds pr. sq. in.	Vacuum in condenser per gauge in inches of mercury.	Throttle open.	Portion of stroke of piston, steam cut off at.	Speed of vessel per hour in knots of 6082⅔ feet.	Bituminous (Cumberland) coal consumed per hour, in pounds.	Wind, Sea, and Sail.
to Feb. 1, 1851,	74	11·39	12·6	26½	$\frac{7}{16}$	0·4	7·410	2826	Moderate head wind; rolling sea; no sail.
and 15, "	49	12·07	9·0	26	$\frac{9}{16}$	0·5	7·400	2611	Moderate head wind; rolling sea; no sail.
, "	14	11·40	13·5	26	$\frac{1}{2}$	0·4	7·500	1848	Strong wind abeam; chopping sea; sail set.
and 13, "	36	11·43	8·0	26	$\frac{9}{16}$	0·5	5·725	2187	Strong wind ahead; heavy head sea; no sail.
and 7, 1850,	48	9·15	10·0	26½	$\frac{1}{4}$	0·4	5·390	1800	Strong wind ahead; heavy head sea; no sail.

necessary to remark here, that the knots of the *Saranac* are 6082⅔ ch, as commonly taken in the British and American Navies; while

the *San Jacinto's* log line was expressly graduated to 6140 feet, or a geographical mile.

General Performance of the Saranac.

From all the steam logs of this vessel at the Navy Department, it appears that the *Saranac* has steamed 978 hours, of which 256 hours were under sail and steam, or about one-fourth the time. Weather generally fine, with ordinary swell and winds.

Mean initial pressure of steam in cylinder (by indicator) above atmosphere per square inch, . . .	9·3 pounds.
Cutting off at, from commencement of the stroke, (·0444+)	4 feet.
Double strokes of piston per minute, . . .	12½
Consumption of Cumberland bituminous coal per hour,	2466 pounds.
Mean effective pressure on piston per square inch (by indicator),	16 "
Horses power developed by the engines, . .	604·6
Speed of the vessel per hour in knots of 6082⅔ feet, . .	8·144.
" " " " 6140 " .	8·068.

Comparison of the Performance of the San Jacinto with that of the Saranac.

In this comparison, the results are taken to be in the proportion of the cubes of the speed, for the powers employed.

	Powers.		Speeds.	Results or Speeds cubed.
San Jacinto,	514·8 horses, or	1·0000	7·580 knots of 6140 ft.	435·5195, or 1·0000,
Saranac,	604·6 "	1·1744	8·068 " " "	515·1678, or 1·2058,

and $\frac{1\cdot2058}{1\cdot1744}=1\cdot027$, showing the application of the power in the *Saranac* to be 2·7 per cent. better than in the *San Jacinto*. There must, however, be applied to this, a mental correction for the influence of the following facts: That the *San Jacinto's* performance was for very deep draft, and in heavy weather; while the *Saranac's* performance was for mean draft, (that is, with half coal out and other weights full,) and in fine weather. These corrections would make the performance of the *San Jacinto* considerably superior to that of the *Saranac*—a result which might have been expected in sea-going vessels, from a well proportioned screw of 14½ feet diameter, making only 25 revolutions per minute, against a common paddle wheel 27½ feet diameter.

The consumption of fuel was as follows:

San Jacinto, . . .	2177 pounds of coal per hour,	or 1·0000
Saranac, ...	2466 " " "	or 1·1328

or nearly in the proportion (1·0000 to 1·1744) of the powers. The boilers, coal, and manner of using the steam, being very similar, this correspondence between power and fuel might have been expected.

Performance of the San Jacinto under Sail alone.

From March 8th, midnight, to March 15th, 8 A. M., the ship was on her course under sail alone, dragging the screw, which being uncoupled, revolved by the reaction of the water. The force and direction of the wind is not given, nor the sail carried; but the mean speed for the whole of the seven days was 7 knots per hour.

Performance of the San Jacinto, with Crippled Machinery.

The air pump of the starboard engine having meanwhile been disconnected, and the exhaust pipe turned up through the hatch of the engine

…em, so as to work that engine non-condensing, the engines were again started on the 15th March. The results tabulated from the steam log are as follows:

Date—March, 1852.	Number of hours.	Revolutions of screw and double strokes of piston per minute.	Steam pressure in boiler per square inch above atmosphere.	Vacuum in port condenser in inches of mercury.	Throttle open.	Portion of stroke of piston, steam cut off at.	Speed of vessel per hour in knots of 6140 feet.	Virginia bituminous coal consumed per hour.	Slip of the screw in per cents of its speed.	Wind, Sea, and Sail.
15	8	21·6	13·0	24·7	5-16	½	6·75	[redacted]	25·45	Light breeze ahead; no sail.
21	9	20·7	12·7	25	5-16	"	4·75	2298	44·75	Strong head wind; no sail.
22	15	19·1	11·2	25¼	5-16	"	2·75	2739	65·33	Strong gale ahead; no sail.
[redacted]	8	21·7	13·0	24½	6-16	"	5·00	2863	44·52	Strong gale ahead; storm, mizzen, and foretopmast staysail set.
24	24	22·0	13·0	25	6-16	"	6·00	3106	34·33	Strong wind ahead; no sail.
25	10	22·0	12·5	24½	6-16	"	6·30	2866	31·05	Strong wind ahead; no sail.

On the 21st and 22d, about forty fathoms of the port main brace, and also a large hawser, got paid overboard, and coiled around the screw, greatly retarding the speed. After it was cleared, the speed of the vessel increased from 2·75 to 5 knots, under nearly equal circumstances of weather.

On the 25th, at 11 A. M., the *San Jacinto* went into Cadiz for repairs, which would not require more than 10 or 12 working days to perform. Coal is cheap at this port, being delivered alongside the ship at $4·25 per ton.

For a further appreciation of the performance of the screw of the *San Jacinto* in heavy head seas and winds, it may be compared with that of the *Glasgow*, one of the fastest and largest ocean merchant screw steamships. On the passage of this vessel from Glasgow to New York, she made from the 11th to the 19th February, 1852, both inclusive, against a heavy head sea and strong wind, no sail set, 6·157 geographical miles per hour. (Vide *Nautical Standard*, March 27, 1852.) Under the same circumstances, the *San Jacinto's* speed is seen to have been 7·58 geographical miles per hour.

---

*Statistics of Gas Works in Great Britain.**

In the United Kingdom, says a contemporary, 855 cities and towns are supplied with gas. Twenty gas-works belong to municipal corporations, or commissioners, and thirty-three to private individuals. 151 companies possess Parliamentary powers, while 682 carry on their business without such powers. (?) The capital invested is 12,300,000*l.*, and the quantity of gas annually manufactured exceeds twelve thousand millions of cubic feet.

* From the London Builder, No. 468.

For the Journal of the Franklin Institute.

Performance at Sea of the U. S. Steamship Fulton. By Chief Engineer B. F. Isherwood, U. S. Navy.*

The following account of the steaming of the *Fulton* from St. Mary's, Florida, to Havanna, during the $3\frac{1}{2}$ days she was making the passage, will show the performance of the vessel at sea under the ordinary circumstances of wind and swell. The mean draft of water was slightly less than the draft with half coal out and all other weights full.

Average steam pressure in boiler per square inch above atmosphere,	28 pounds.
Initial " cylinder " "	26·3 "
Average vacuum in condenser, of mercury, . .	27 inches.
Steam cut off at, from commencement of stroke of piston,	3 feet.
Mean effective steam pressure per square inch of piston, calculated for 2 pounds greater back pressure than in the condenser, and including expansive effect of steam in nozzles, clearance, &c.,	25 pounds.
Bulk of steam comprised between cut-off valve and piston at one end of cylinder, ...	3·094 cubic feet.
Double strokes of piston per minute, ...	$19\frac{1}{2}$.
Horses power developed by the engine, ...	599·5.
Soft anthracite consumed per hour, . . .	2200 pounds.
Speed of the vessel per hour in knots of 6140 feet, .	$10\frac{3}{4}$.

Evaporation by the Boilers.

The space displacement of the piston per stroke of 10 feet 4 inches, is 140·9 cubic feet, and for 3 feet of that stroke is 40·644 cubic feet, to which add the space comprised between cut-off valve and piston, 3·094 cubic feet, making a total of 43·738 cubic feet of steam of the total pressure of 41 pounds per square inch, used per stroke; which per hour would become $(43{\cdot}738 \times 19\frac{1}{2} \times 2 \times 60)$ 10234·69 cubic feet: to this must be added the loss by *blowing off*, so as to maintain the density of the water in the boilers at $\frac{2}{32}$.

The temperature of steam of the above pressure is 270·6° F., taking the temperature of the hot well at 100° F., and the total heat of steam at 1202° F., (neglecting small corrections, which would be out of place applied to data taken from the ship's log,) the proportion of caloric expended on the water evaporated would be (1202°—100°) 1102°; and on the water blown out (270·6°—100°) 170·6°, which is 13·4 per cent. of the sum (1102°+170·6°=1272·6) of the two, leaving 86·6 per cent. as the amount utilized. Increasing the evaporation in this proportion, we obtain $\left(\frac{10234{\cdot}69 \times 100}{86{\cdot}6}\right)$ 11818·35 cubic feet of steam per hour. The relative volumes of this steam and the water from which it is generated are 664 and 1, which give for the water evaporated $\left(\frac{84504{\cdot}80}{664}\right)$ 177·99 cubic feet. Taking the weight of a cubic foot of sea water at 64·3 pounds, there would be evaporated per hour by 2200 pounds of soft anthracite, $(177{\cdot}99 \times 64{\cdot}3)$ 11444·757 pounds of sea water, or 5·202 pounds of water per pound of coal.

* See ante, pp. 195 and 122.

Slip of the Paddle Wheels.

The circumference of the centre of effort of the paddle wheels is 72·26 feet; consequently,

$72{\cdot}26 \times 19\frac{1}{3} \times 60 = 84544{\cdot}20$ feet = speed centre effort paddles per hour.
$10\frac{3}{4} \times 6140 \qquad = 66005{\cdot}00$ feet = speed of vessel per hour.

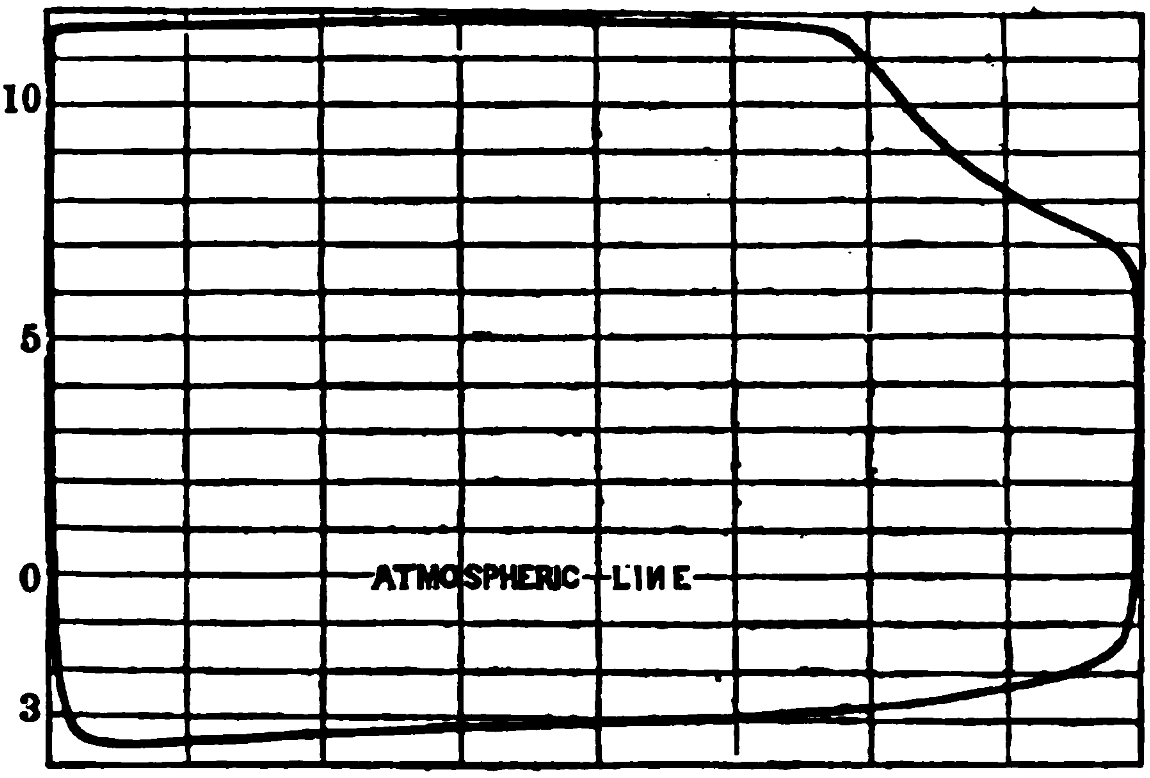
18539·20 feet = slip centre effort paddles per hour, or 21.93 per cent.

Indicator Diagrams.

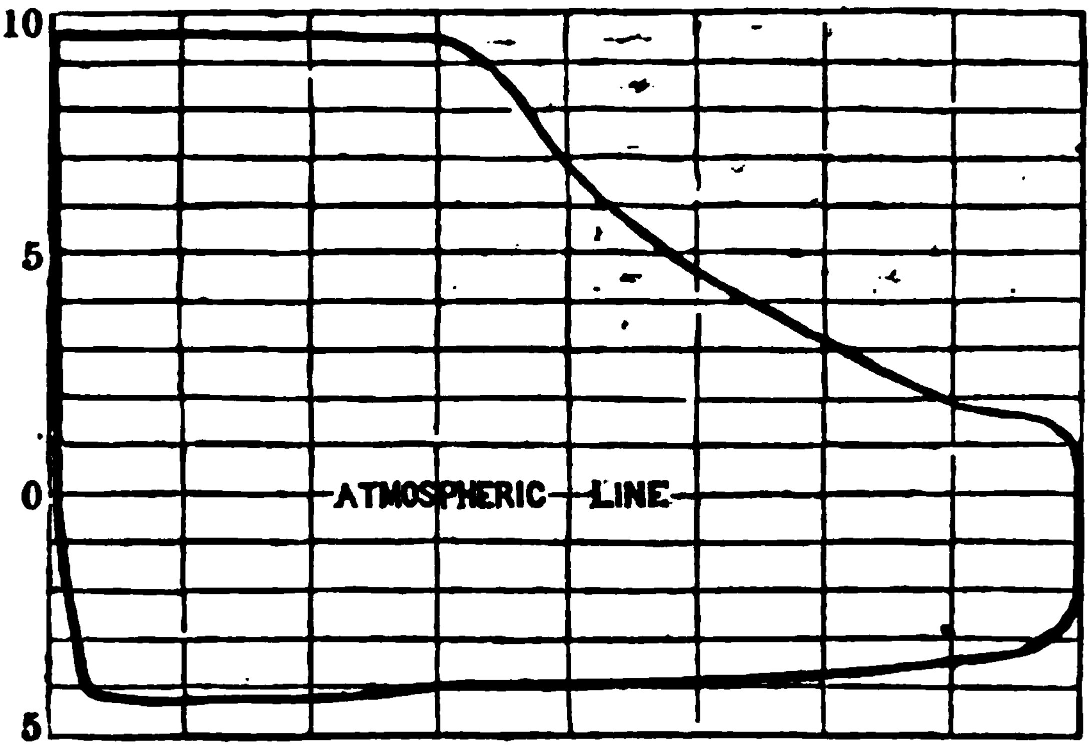
The indicator diagrams are added to show the action of the valves and the manner of using steam. The cut-off is Sickels', and momentarily adjustable. Under ordinary steaming at sea, the blowers are only used occasionally, when cleaning fires, pumping up, &c.

The indicator diagrams were taken in New York Bay, with the vessel deep laden, ready for a cruise.

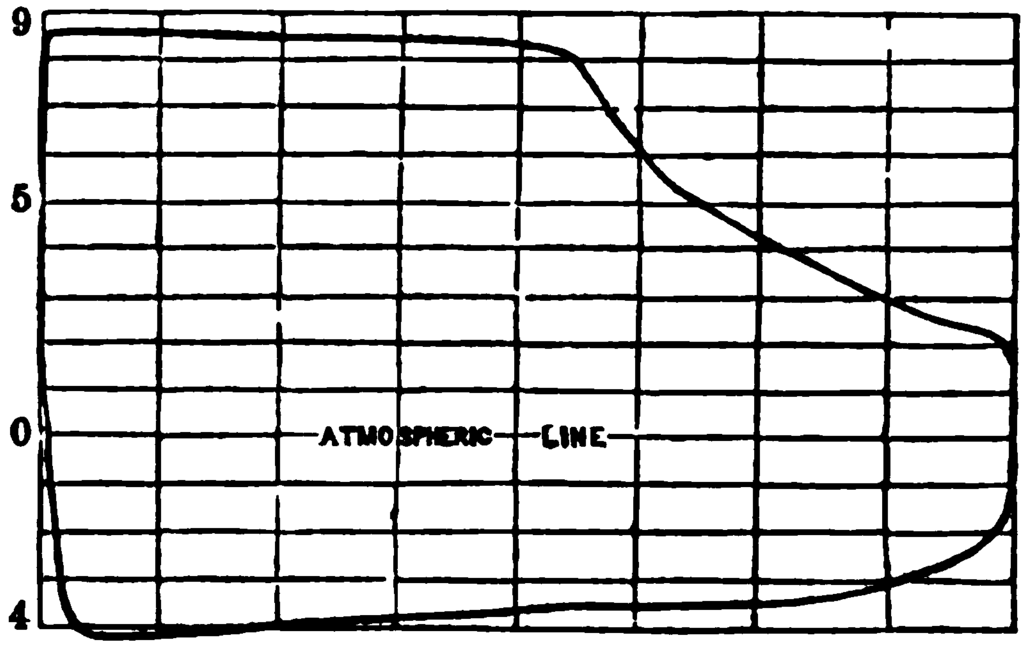
No. 1. Initial steam pressure in cylinder per square inch of piston above atmosphere, 35 pounds; cut off at three-fourths stroke of piston. Mean effective pressure throughout stroke of piston, $41\frac{1}{2}$ pounds. Double strokes of piston, 23 per minute.



No. 2. Initial steam pressure in cylinder per square inch of piston above atmosphere, 29 pounds; cut off at full three-eighths stroke of piston. Mean effective pressure throughout stroke of piston, $30\frac{1}{2}$ pounds. Double strokes of piston, 20 per minute.



No. 3. Initial steam pressure in cylinder per square inch of piston above atmosphere, 25½ pounds; cut off at $\frac{9}{10}$ths stroke of piston. Mean effective pressure throughout stroke of piston, 30½ pounds. Double strokes of piston, 20 per minute.



It will be observed, that the double strokes of piston were nearly in the proportion of the square roots of the effective pressure on it.

The square root of 41½ is 6·442; of 30½ it is 5·523; or the two are in the proportion of 1·166 to 1·000.

The double strokes of piston, 23 and 20, are in the proportion of 1·150 to 1·000.

For the Journal of the Franklin Institute.

U. S. Screw Steam Tug "John Hancock." By Chief Engineer B. F. Isherwood, U. S. Navy. (*With a Plate.*)

The *John Hancock* was constructed in 1850, to answer the double purpose of a steam tug and water tank for the U. S. Navy Yard at Charlestown, Mass., where she has since been stationed, with the exception of short cruise to the Gulf of Mexico, during the *fillibuster* excitement of the Lopez expedition. On that occasion she was brig rigged, and carried battery. The results hereinafter given are the mean of her performance at sea, without sail, under ordinary circumstances of weather.

The hull was built at the Charlestown Navy Yard. The machinery was constructed at the Washington Navy Yard, by Mr. Ellis, from the designs of Mr. Charles W. Copeland.

Hull.—Length between perpendiculars,		113 feet.
Beam, extreme,		22 "
Depth of hold,		9 "
Burthen,		208 tons.
Draft of water with half coal in, and all other weights full,	forward,	6 feet.
	mean,	8¼ "
	aft,	10½ "
Immersed amidship section at the mean draft of 8¼ square feet,		154 square feet.
Square feet of immersed amidship section per cubic foot of space displacement of piston, multiplied by number of double strokes of piston per minute,		0·036.
Square feet of immersed amidship section per cubic foot of space displacement of piston,		2·017.

–Two oscillating non-condensing engines.

r of cylinders, ...	1 foot 8 inches.
f piston, ...	1 " 9 "
splacement of both pistons per stroke, . .	7·636 cubic feet.
ective steam pressure per square inch of piston, .	25 pounds.
trokes of piston per minute, . . .	55½.
orses power developed by the engines, . .	79·25.

n effective pressure is calculated for an initial cylinder pres- pounds less than the boiler pressure, and for a back pressure s greater than the atmosphere, cutting off at three-fourths the the commencement, and allowing for the effect produced by : feet of space comprised between the steam valve and piston. ight of engines, including propeller shaft cased in brass, 38,955

D PROPELLER (Plate VI.).—One, of bronze, twist-bladed, but *not* a true screw, stern of the vessel, and connected directly to the engines.

, ...	8 feet.
f periphery in direction of axis, ...	3 "
periphery, ...	18·040 feet.
hub, ...	6·310 "
· of hub, ...	1·250 "
ch in function of total helicoidal surface, . .	15·265 "
ch of the surface comprised between a diameter of 4 feet the periphery, which may be considered as the *effective* elling surface, and from which the slip is calculated,	16·739 "
periphery from a line at right angles to axis, .	35° 40′.
hub from a line at right angles to axis, . .	58° 7′.
of blades, ...	3.
licoidal area of blades, ...	44·135 square feet.
jected area of blades on a plane at right angles to axis,	30·333 "
helicoidal area (between diameter of 4 feet and periphery),	32·856 "
projected area, " " "	24·488 "
n of the total helicoidal area of the propeller to immersed lship section of hull, ...	1·000 to 3·489.
n of the total projected area of the propeller to im- sed amidship section of hull, ...	1·000 to 5·077.
of the propeller, ...	2830 pounds.
he propeller, ...	25 cents per lb.

wing table will show the angles, corresponding pitches, &c., oidal surface of the propeller at various points from hub to The calculations are made by supposing that surface to be a number (7) of parallel bands or strips, called elements, ar as concentric circles when the propeller is viewed as a disk. and *pitches* are those normal to the centre lines of the elements. are calculated as the heights of a series of right angled trian- ich the bases are the circumferences normal to the radii of the nents, and the angles given made with the circumferences by neuses. Were one convolution of the thread used, the whole l be employed, but as less than a convolution is used, only a *the pitch* is used, and this fraction varies for the different ele- rding to the length of the propeller at those elements in the the axis. The *total lengths of the elements* are the hypothe- series of right angled triangles, whose bases are the circum- d whose heights are the pitches normal to those elements.

The *length of element used* is the total length multiplied by the corres ponding fraction of the pitch.

Radii of elements.	Circumferences normal to radii of elements.	Angles of elements from a line at right angles to axis.		Pitches of elements.	Lengths of elements.	Fractions of pitches used.	Lengths of elem'ts used.	Breadths of elem'ts.	Areas of elements.
A	B	H		C	[illegible]	E	F	G	
	$2A \times 3{\cdot}1416$			$\frac{B \times \text{sine } H}{\text{sine supplement } H}$	$\sqrt{B^2+C^2}$		$D \times E$		$F \times G$
feet.	feet.	°	′	feet.	feet.	pr. ct.	feet.	feet.	sq. feet.
0·812	5·165	55	33	7·443	9·025	0·600	5·4150	0·375	2·0310
1·250	7·854	52	31	10·242	12·907	0·611	7·8362	0·500	3·9431
1·750	10·995	49	29	12·664	16·122	0·627	10·6101	0·500	5·3051
2·250	14·137	46	27	14·872	20·526	0·700	14·3682	0·500	7·1841
2·750	17 276	43	24	16·431	23·780	0·700	16·6460	0·500	8·3230
3·250	20·420	40	22	17·357	26·800	0·661	17·7148	0·500	8·8574
3 750	23·562	37	20	17·978	29·638	0·573	16·9826	0·500	8·4913
				Helicoidal area of propeller, . .					44·1350

Boiler (Plate vi.)—One iron boiler, with single return ascending flues.

Length of boiler, ... 22 feet.
Breadth, " . . . . 6 " 3 inches.
Height, " . . . . 7 " 5 "
Contents of circumscribing parallelopipedom, . . 1019·64 cubic feet.
Area of heating surface, ... 755 square "
Area of grate surface, ... 28 " "
Capacity of steam room in boiler, ... 200 cubic "
" " boiler, steam pipes, &c., . . 205 " "
Cross area of the two lower rows of flues, . . . 4·636 square "
" upper row of flues, ... 4·276 " "
" smoke chimney, ... 4·909 " "
Height of smoke chimney above grate, . . . 37 feet 9 inches
Mean pressure of steam above atmosphere per sq. inch in boiler, 31 pounds.
" " " " cylinder, 28·3 "
Cutting off at, from commencement of stroke, (¾the stroke,) 15¾ inches.
Space comprised between cut-off valve & piston, (both cylinders,) 0·664 cubic ft.
Double strokes of piston per minute, . . . 55½.
Consumption of bituminous (Cumberland) coal per hour, with
natural draft, ... 598 pounds.
Weight of sea water in boiler, ... 22,700 "
" boiler and smoke chimney, . . . 26,667 "
" boiler grate bars, ... 2260 "

Proportions.—Proportion of heating to grate surface, . 26·964 to 1·
Proportion of grate surface to cross area of the two lower rows
of flues, 6·040
" " " upper row " 6·548
" " " of smoke chimney, 5·704
" heating surface to cross area of the two lower rows
of flues, 162·856
" upper row " 176·567

Square feet of heating surface per cubic foot of space displacement of piston, 13·356.
" " " of space displacement of piston, per double stroke of piston per minute, 0·241.
Square feet of grate surface per cubic foot of space displacement of piston, 3·667.
" " " " " per double stroke of piston per minute, 0·066.
Cubic feet of steam room to cubic foot of steam used per stroke, 25·309.
Consumption of bituminous coal with natural draft per square foot of grate surface per hour, . . . 21·360 pounds.
Sea water evaporated from temperature of 212° F. by one pound of bituminous coal per hour, ... 7·651 "
Sea water evaporated from temperature of 100° F. by one pound of bituminous coal per hour, . . . 6·938 "
Sea water evaporated from temperature of 212° F. by one square foot of heating surface per hour, . . . 6·061 "
Total cost of boiler and smoke pipe, (26,667 pounds,) $2428·13, or 9·1 cents per lb.

The evaporation is calculated for an initial cylinder pressure of 1·7 ›unds less than the boiler pressure; the feed water was by means of a :ater furnished to the boiler at a temperature of 212° F.; the point of .tting off was at three-fourths the stroke from the commencement. Three-urths the space displacement (7·636 cubic feet) of both pistons is 5·727 ıbic feet, to which add the spaces comprised between the cut-off valve ıd piston, 0·664 cubic feet, at one end of each cylinder, and there re-lts (5·727+0·664) 6·391 cubic feet of steam of 43 pounds per square ch total pressure used per stroke; the number of double strokes per inute being $55\frac{1}{2}$, there would be used per hour ($6{\cdot}391 \times 55\frac{1}{2} \times 2 \times 60$) 564·06 cubic feet. The relative volumes of steam of 43 pounds per ıare inch pressure, and the water from which it is generated, is as 635 1. The water evaporated would then be (42564·06÷635) 67·03 cubic t, which, taking the cubic foot of sea water at 64·3 pounds, would be .0·029 pounds. To this must be added the loss by blowing off at $\frac{2}{32}$. cing the total heat of steam at 1202° F., and the temperature of the feed :er at 212° F., there would be supplied to the feed water by the fuel ›° F. of heat. The temperature of the steam is 273° F.; the difference ween the temperature of the feed water and the water blown out is 3° — 212°) 61° F., and as equal quantities of the water pumped into boiler are evaporated and blown out, the proportion of the heat ex-ıded in evaporating will be 990°, and in blowing out 61° F. The total ıt furnished by the fuel will be then (990°+61°) 1051°, and of this, ›, or 5·8 per cent., is lost, leaving (100· — 5·8) 94·2 per cent. utilized, l if 94·2 per cent. evaporates 4310·029 pounds, 100 per cent. will eva-ate 4575·4 pounds. The amount of fuel consumed per hour was 598 ınds; consequently one pound of fuel evaporated (4575·4÷598) 7·651 ınds of sea water from a temperature of 212° F.

To obtain the evaporation from a temperature of 100° F., in order to npare it with the results from the boilers of condensing engines, where : feed water is supplied of that temperature, it is necessary to consider ıt the latent heat of steam is 990°, which increased by 212°, (the tem-:ature of the feed water for which the evaporation has been obtained,) ıounts to 1202°; also, the same latent heat (990°) increased by 100°, e temperature of the feed water for which the evaporation is to be

obtained,) amounts to 1090°. Hence the proportion in the first case tween the latent and the sum of the latent and sensible heats is as

$$990 : 1202, \text{ or as } 1{\cdot}0000 : 1{\cdot}2142,$$

and in the second case it is as

$$990 : 1090, \text{ or as } 1{\cdot}0000 : 1{\cdot}1010,$$

and as the proportion of 1·2142 to 1·0000 gave 7·651 pounds, the p portion of 1·1010 to 1·0000 will give 6·938 pounds.

The ashes, clinker, and refuse of the coal from the furnaces amount to 12·8 per cent. of the total weight of the coal put into the furnaces.

PERFORMANCE.—Of the entire time of steaming, during one-half th was a light fair wind, and the remaining half a light breeze ahead. Or nary sea, and no sail set. Speed of the vessel, 6·411 knots of 6082⅔ f per hour. Steam pressure in boiler above atmosphere per square inch, pounds, cutting off at three-fourths the stroke from the commenceme Consumption of best Cumberland (bituminous) coal, 598 pounds per ho Revolutions of the propeller, and double strokes of engines, 55½ minute.

SLIP OF THE PROPELLER.—Taking the pitch of the propeller at 16· feet, the slip would be as follows:

16·739 × 55½ × 60	= 55740·870 feet	= speed of propeller per hour.	
6·411 × 6082⅔	= 38995·976 "	= " vessel "	
	16744·894 "	= slip of propeller "	or 30·04 per c

Comparison of the "John Hancock" with the U. S. Paddle Wheel Steam "Spitfire."

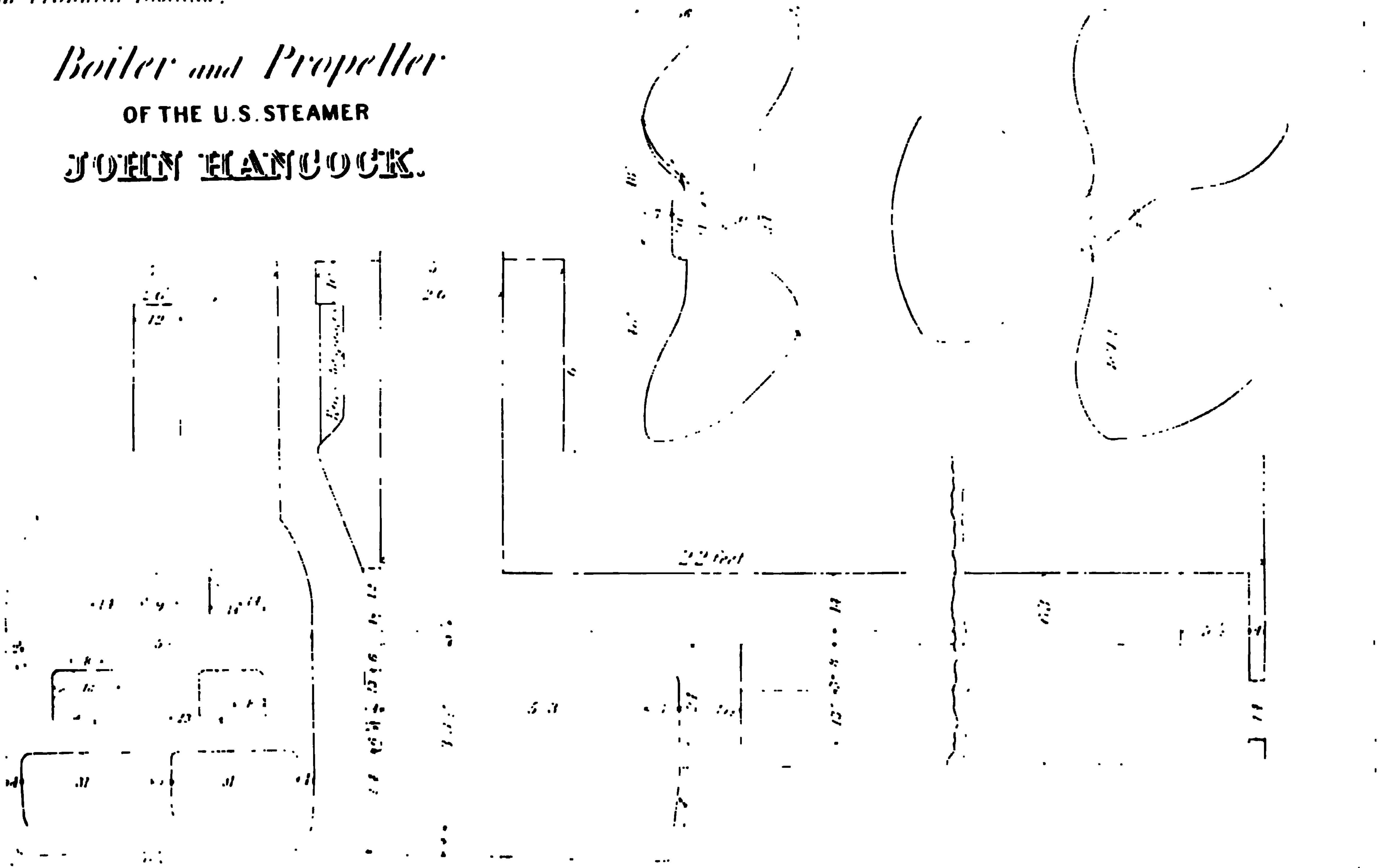
Being in possession of the log of the *Spitfire*, (a small war steamer, w a condensing engine, and having about the same resistance of hull as t *John Hancock*,) giving her mean performance at sea, a comparison of t relative efficiency of the two modes of propulsion can be made under t circumstances in which they were intended to be employed, viz: at se and loaded and trimmed as war steamers.

		John Hancock.	Spitfire.
HULL.	Length between perpendiculars,	113 feet.	...
	Length on deck,	...	118 feet.
	Extreme beam on deck	22 "	22½ "
	Depth of hold,	9 "	11 "
	Mean draft of water,	8½ "	7½ "
	Area of immersed amidship section at mean draft,	154 square feet.	154 sq. fee
	Horses power developed by the engines,	79·250	89·936
	Speed of vessel in knots of 6082⅔ feet per hour,	6·411	6·390
	Slip of propelling instrument,	30·04 per cent.	13·34 pr.

Considering the cubes of the speeds as the measures of the resistanc we have a resistance of $(6{\cdot}411^3)$ 263·498 overcome by a power of 79·2 in the case of the *John Hancock*, and a resistance of $(6{\cdot}39^3)$ 260·9 overcome by a power of 89·936 in the case of the *Spitfire;* and

$$\frac{263{\cdot}498}{79{\cdot}250} = 3{\cdot}325 \text{ and } \frac{260{\cdot}917}{89{\cdot}936} = 2{\cdot}901;$$

Boiler and Propeller
OF THE U.S. STEAMER
JOHN HANCOCK.



equently the application of the power was better in the *John Hancock* in the *Spitfire* in the proportion of 3·325 to 2·901, or as 1·0000 to 25, supposing the two vessels to offer equal resistance to the power. will be observed that there was a great inequality in the slips of the elling instruments of the two vessels, that of the *John Hancock* being per cent., while that of the *Spitfire* was 13·34 per cent., a differof 16·70 per cent. The loss by oblique action with the paddle l of the *Spitfire* was 18·50 per cent., making the sum of the losses e paddle wheel (13·34+18·50) 31·84 per cent.

e powers (79·250 and 89·936 horses) exerted in the two vessels were ross powers developed by the engine. A more accurate idea of the ve efficiency of the propelling instruments will be obtained by reg these powers to the portions applied to the propelling instruments. consideration of the friction of the load can be omitted, as it would oportional to the load.

ginning with the *Spitfire*, it may be taken that the power required ercome the friction of the engine alone is 1 pound per square inch ston, and the power required to work the air pump is 0·7 pound per e inch of steam piston. The mean effective pressure per square inch ston was 18 pounds. The per centage of power, therefore, lost in ing engine and air pump would be $\left(\frac{1\cdot 7 \times 100}{18}\right)$ 9·444 per cent., and per cent. of 89·936 is 8·494, leaving 81·442 horses.

e engines of the *John Hancock* being non-condensing, their gross r will only have to be reduced by the 1 pound per square inch of n required to work them. Their mean effective pressure per square of piston being 25 pounds, 1 pound would be 4 per cent., and 79·25 ished 4 per cent. is 76·08 horses.

e comparison of powers with effects or resistances overcome by rs applied to propelling instruments will be as—

$$\frac{263\cdot 498}{76\cdot 08} = 3\cdot 4634, \qquad \text{and } \frac{260\cdot 917}{81\cdot 442} = 3\cdot 2037;$$

quently the propeller of the *John Hancock* was more efficient, economly, than the paddle wheel of the *Spitfire*, in the proportion of 3·4634 2037, or as 1·000 to 0·925.

the data used in these latter calculations, both of power and resist-are only general practical averages, and not critically accurate for articular cases, the results cannot be depended on within a few per ; consequently we are only entitled to conclude that the two prog instruments were equally efficacious.

st and Weight of Machinery.—The neat cost of propeller, engines, oiler was $7562·35, in which is included 10,000 pounds of brass gs. Cost of patterns, additional, $487·47. The total weight of pro-, engines, and boiler, exclusive of water, is 70,712 pounds. The e frames were of wrought iron, with finished columns.

On the Electro-Magnetic Motor of Fessel. By M. Plucker.*

It is known that Mr. Page, a physicist in North America, has recently endeavored to produce a motive power by an extended application of the force which attracts a mass of iron within an electro-magnetic helix. Th. Hankel, of Leipzic, has made the same attempt, and has established an important practical law, namely, that this force is as the square of the power of the current. M. Fessel has on his part constructed a model of a machine at my request, the value of which I am not for the moment able to appreciate in case it were made on a large scale, but which as a piece of physical apparatus explains and clears up the application of the force in question.

The model of Fessel is formed of two helices placed end to end in a horizontal position. They serve to conduct the current always in the same direction, but in such a way that it traverses alternately each of the two helices, and consequently only one at a time. In the interior of the helices is a bar of iron, which is alternately attracted from the one into the other by constantly maintaining the same polarity, and which thus executes a motion backwards and forwards. To the two extremities of the bar are fixed two slender horizontal shanks of brass, which rest upon two pullies attached to the two extremities of the apparatus, and which thus support the whole weight of iron. One of these shanks sets a wheel in motion. A commutator is moved by an eccentric by means of a directing-rod, which is placed so as to be able to make the machine move backwards and forwards as in steam-vessels. In one of the machines the commutator has been fixed immediately to the axis.

Two couples of Grove's cells are sufficient to communicate to this apparatus a great rapidity. With six couples, the rapidity became such that it threatened to break the apparatus; and fearing this, I stopped the passage of the current.

I have just received from him the news that he has nearly completed the construction of a new apparatus, in which he has replaced the pulleys by oscillating shanks of metal rod, similar to the oscillating cylinders of the steam engines.—*Bibliothèque Universelle de Genève, December*, 1851.

For the Journal of the Franklin Institute.

Explosion of the Steamboat "Pocahontas." By A. C. Jones, Engineer.

To the Committee on Publications.

On February 18, 1852, the steamboat *Pocahontas*, in backing out from a wood yard on the Arkansas river, collapsed both flues of the middle boiler, scalding eighteen persons, of whom eight died within a few hours after. The three boilers are two years old, 28½ feet long, 38 inches in diameter, with 14-inch flues. By inspection, I found that half of each flue is torn from the after head; one flue is flattened vertically, and the other one horizontally; the end sheet of one is much laminated, and has been burned in turning the flanch on it. The iron is scant one-quarter inch thick;—this is entirely too light, particularly if they carried the steam

* *From* the Lond., Edinb., and Dublin Philosoph. Magazine, February 1852.

extreme of the pressure gauge, (200 lbs.) The time elapsed has rated the marks of the water line—the flues appear as if they had partially overheated. The position of the gauge cocks in the out-boilers show that these were worked on the scant water system. The le boiler has *no gauge cocks in it*, and yet the inspector's certificate, l New Orleans, January 24, 1852, pronounces them in good order! hell is uninjured, and no other damage was done to the boat.

For the Journal of the Franklin Institute.

es on the Steamship "State of Georgia." By J. V. Merrick, Esq.

(With a Plate.)

is steamer, before noticed in this *Journal*, has recently been com-d, and will leave this port as pioneer of the line to Savannah, Geo., e 12th of May. Her engineer's trial trip was made on the 27th and April, 1852, and an account of her performance, with the principal nsions, &c., will doubtless be interesting to many readers.

constructed by Vaughan & Lynn, Kensington.

Length on deck,	210 feet.
" between perpendiculars,	200 "
Breadth,	33 "
" over guards, (extreme,)	56 " 10 inches.
Depth of hold,	21 "
Depth of lower hold,	13 "

with three masts; three square sails on foremast; fore and aft sails on main and mizzen mast.

r, loaded, estimated at 12 ft. 6 in., to 12 ft. 9 in., which is about 6 inches more than was intended, owing to the unusual size and weight of timbering.

inery constructed by Merrick & Son, Southwark.

Space occupied in lower hold, by machinery and full complement of coal (155 tons,) is 54 feet 9 inches long, and whole width of ship as follows:—

Engine space, 13½ feet wide, with bunks on each side,	30 feet 9 in.
Fire room,	8 " 3 "
Boilers,	14 "
Passage forward of boilers,	1 " 9 "
Total,	54 " 9 "

Between decks, space 12 feet 3 inches wide, and 46 feet long; centre of shaft, 80 feet forward of stern post.

e, single side lever, with condenser below cylinder; air pump on same end, and outside steam chests having balance valves.

Cylinder,	72⅝ in. diam. 8 ft. stroke.
Nominal horse power,	220·6
Air pump,	46½ in. dia., 37 in. stroke.
Lead on steam valves (lift,)	⅛ inch.
Lead on exhaust valves (lift,)	13-16 inch.

Is fitted with H. Allen's momentarily adjustable cut-off arrangement.

e Wheels, ordinary radial, with single floats.

Diameter over floats,	29 feet 4 inches.
Width of "	9 " 3 "
Depth of "	1 " 10 "
Number of "	28
Mean dip on trial,	4 " 4½ "

BOILERS (Plate VII.); two return tubular, natural draft; dimensions of each:

Length,	14 feet.	
Width,	12 "	
Height,	10 "	10 inches.

240 tubes of 3 inches inside diameter; 9 feet 6 inches long.

4 furnaces with brick bridge walls.

Heating surface, (to 12 inches above tubes.)

4 Furnaces and back connexions,	452	square feet.
Tubes,	1774	"
Front connexion,	76	"
Total in each,	2302	"
" both,	4604	"
Grate surface, " "	145	"
Cubical contents, (without drums,) " "	2077	cubic feet.
Water space, (to 12 inches above tubes,) "	1374·4	"
Steam space, including drums, "	1017	"
Weight of each boiler,	38,600	pounds.
" water in each boiler,	43,980	"
" each boiler filled,	82,580	"

or, 73¾ tons total for both.

SMOKE STACK.—

Diameter, 5 feet 9 inches.

Total height above bars, 60 feet, as follows:

From bars to centre of tubes,	3 feet	9 inches.
" centre of tubes to top of drum,	15 "	3 "
" top of drum up,	41 "	
	60 "	0 "

PROPORTIONS.—

Heating surface to cubic foot of cylinder,	20·40 to 1·00
" " grate surface,	31·75 " 1·00
" " pounds fuel per hour,	2·39 " 1·00
" " nominal horse power,	20·93 " 1·00
Grate surface to area over bridge,	1· " 0·127
" " area in tubes,	1· " 0·163
" " " chimney,	1· " 0·180
Steam space to cubic foot of cylinder,	4·5 " 1·00

PERFORMANCE.—Trial Trip made down the Delaware river and out to sea.

Mean draft of water on trial, forward,	10 feet 7 inches.
" " aft,	12 " 5½ "
" " mean,	11 " 6¼ "
Midship section immersed at that draft,	345·5 square feet.

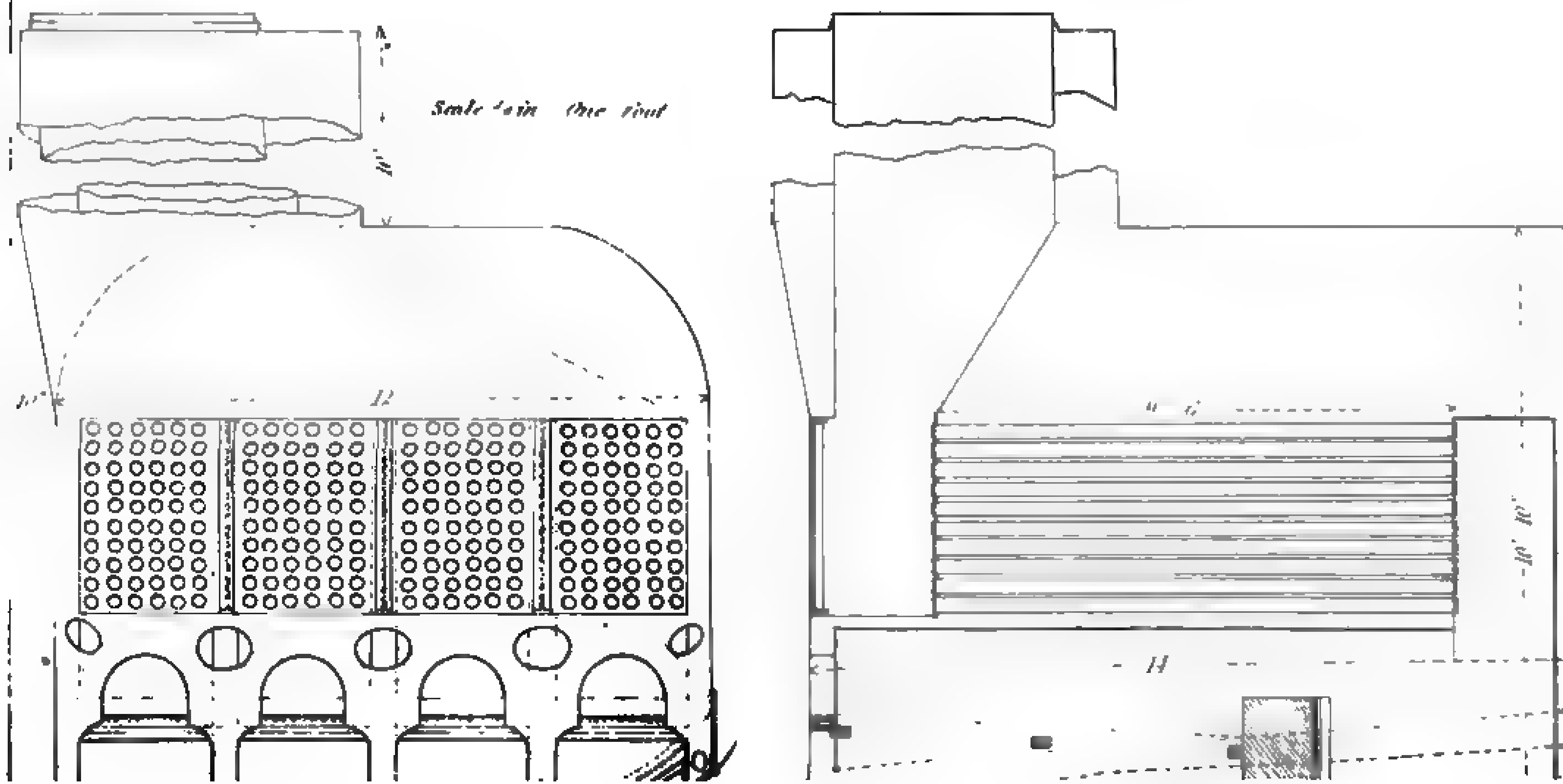
Time and distance made; downward trip.—April 27.

	Time.			Distance from starting point.	Tide and other remarks.
Passed Navy Yard Shears,	9h.	15 m.	A. M.	Miles.	Ebb almost ½ down.
" Fort Mifflin, (stopped 10 min.)	9	50	"	8·25	"
" Marcus Hook,	10	51	"	20·25	"
Stopped twice below Marcus Hook to repair disarrangement of valve gearing; in all	2	48			Met flood at 1 P.M. 30 miles below city.
" Delaware City,	2	51	P. M.	40·50	
" Ledge Lightboat,	6	8	"	77·00	Took ebb tide.
" Breakwater Lighthouse,	7	48	"	103·50	
Total time,	10	34			
Running time,	7	36		103·50	

Boilers of Steamer "State of Georgia."

BY MERRICK & SON,

Philada 1852.



stimating the tide current $2\frac{1}{2}$ miles per hour, in favor $4\frac{1}{4}$ hours, and osed $3\frac{3}{8}$ hours, the actual distance run was 103·5—2·2=101·3 miles, in still water, speed per hour was $\frac{101\cdot3}{7\cdot6}$=13·33 statute miles.

Time and distance made, April 28.

sed Breakwater Lights,	6 h. 3 m.	A. M.	on S. E. course.		Moderate breeze from S. W., and light swell; at 7 30, wind veered to the westward and came out strong from N. N. W.
Put about,	7 48	"	about 22 miles out.		
sed into Breakwater,	10 3	"			Tide ebb; wind nearly ahead; continued till below Reedy Island, (3 30, P. M.); after which, wind abeam to the City.
Rounded past Lewes, Dela.					
' out of Breakwater,	10 20	"			
(Stopped 9 minutes.)					
' Ledge Light-boat,	12 49	P. M.		26·50	
' Delaware City,	3 50	"		63·	No tide till 4 h. 15 m. when flood tide overtook the vessel.
' Marcus Hook,	5 15	"		83·	
' Fort Mifflin,	6 5	"		95·25	Tide moderate, owing to N. W. wind blowing all day.
' Navy Yard,	6 37	"		103·50	
Total time,	8 17				
Running time,	8 8				

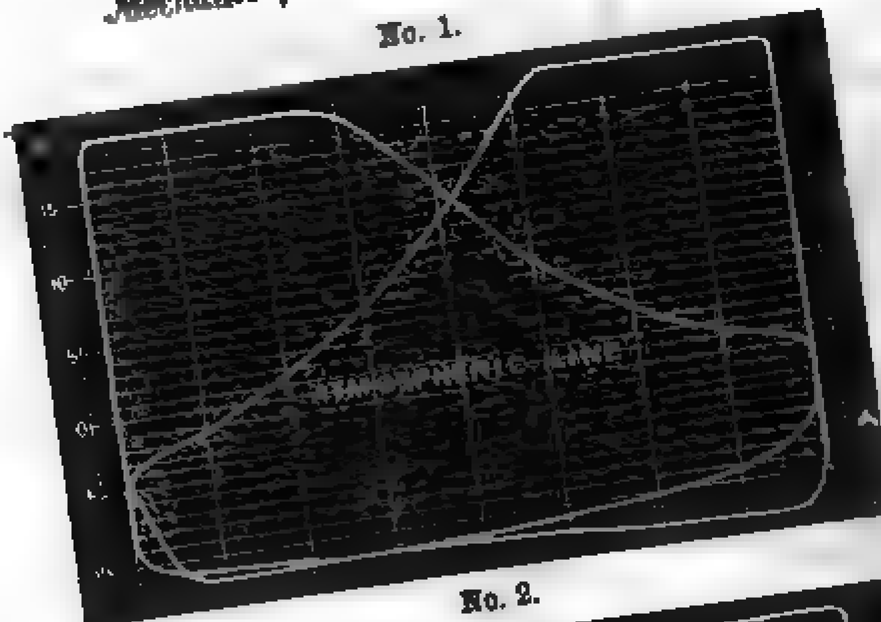
The force of the wind may be estimated by comparing the time running out and returning (22 miles,) at sea. 22÷1·75=12·57, and 22÷2.25 ·77 miles per hour; difference owing to wind on return=2·8 miles per r. On the upward trip, tide in favor 2 h. 22 m., opposed 2 h. 42 m. ual distance run, 103·5—0·7=102·8 miles in 8 h. 8 m., or $\frac{102\cdot8}{8\cdot13}$= 56 statute miles per hour. Assuming the retardation from the wind miles per hour only, for one half the running time, would give the ed = 13·66 miles per hour.

The average pressure in boilers, pressure in cylinder, (from indicator ds,) number of revolutions, point of cutting off, &c., were as follows:

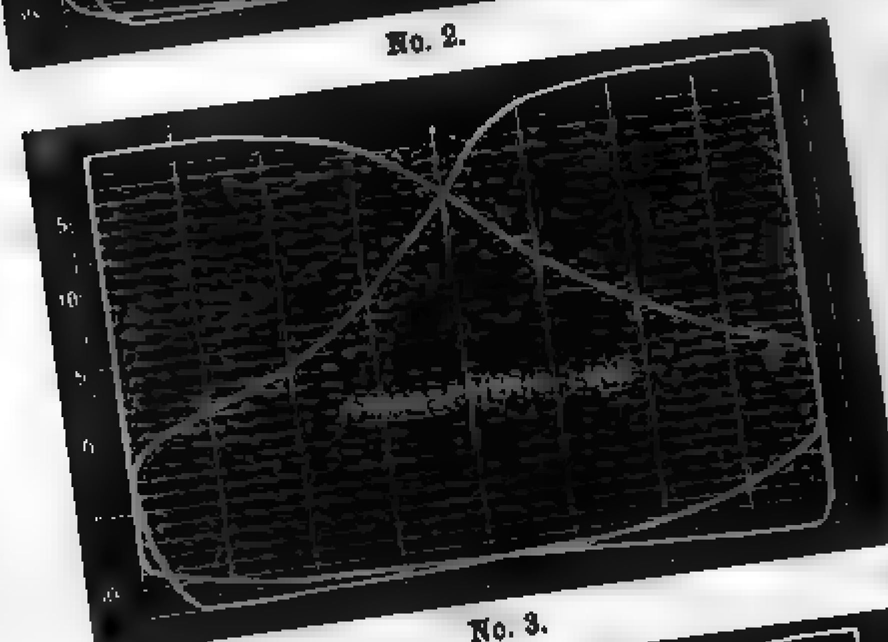
	1. Total duration. *Hours.*	2. Pressure of steam above atmos. *Boilers.*	3. Mean pressure above atmos. *Cylinder*	4. Effective pressure on piston.	5. Revols. per minute.	6. Mean point of cutting off.
nward trip, ...	8·45	20·52	17·80	20·34	16·17	3 ft. 2 in.
ng to sea, &c. . .	4·27	21·50	16·75	19·95	14·80	3 " 1 "
ward trip, ...	8·08	20·47	17·32	19·95	16·50	3 " $2\frac{1}{2}$ "
rage in river, . . .	16·53	20·50	17.56	20·15	16·28	3 " $2\frac{1}{4}$ "
rage in whole trip, .	21·20	20·70	17·40	20·10	16·05	3 " 2 "

There were taken during the trip, about 30 indicator diagrams, (of ch four examples are given,) from which the above results were carey averaged. The 3d column is the *average* pressure during admis of steam, and of course covers the effect of "wire-drawing."

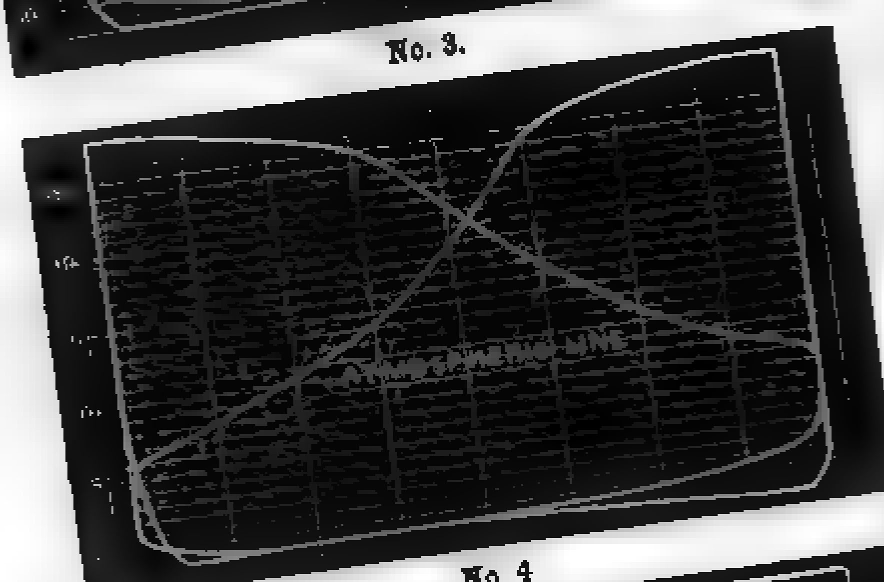
No. 1.



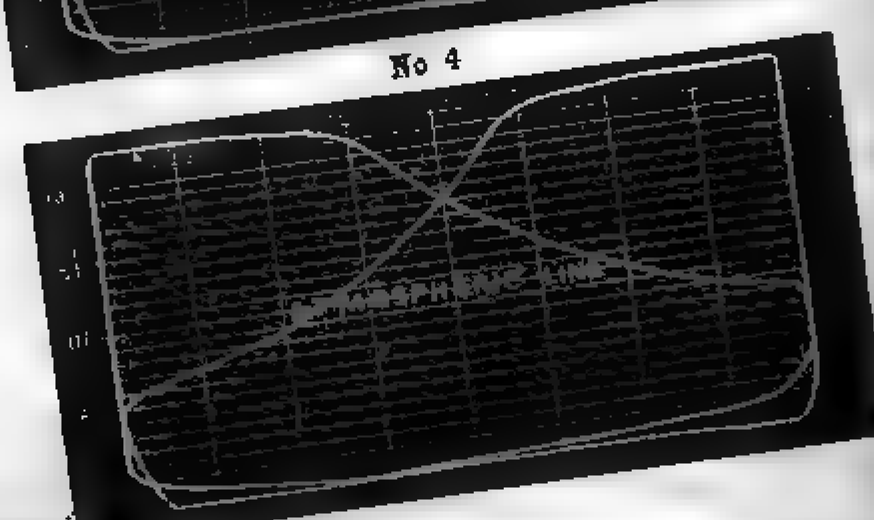
No. 2.



No. 3.



No 4



. 1.—Taken at 3 h. 8 m. P. M., April 28th, Delaware River; revo-
s per minute, 17; steam pressure in boilers, 21 lbs., cutting off at
10 in.; vacuum, 26 inches; throttle $\frac{5}{8}$-ths open; average effective
ure, $= \frac{21{\cdot}34+21{\cdot}23}{2} = 21{\cdot}29$ lbs.

. 2.—Taken at 4 h. 48 m. P. M., April 27th, Delaware Bay; revo-
s per minute, 18; steam pressure in boiler, $22\frac{1}{2}$ pounds, cutting
3 feet 4 inches; vacuum, 26 inches; throttle $\frac{3}{8}$-ths open; average
ive pressure, $= \frac{22{\cdot}65+22{\cdot}03}{2} = 22{\cdot}34$ pounds.

. 3.—Taken at 8 h. 55 m. A. M., April 28th, at sea; going in
s, strong wind on port bow; revolutions per minute, 14; steam pres-
n boilers, $20\frac{1}{2}$ pounds, cutting off at 3 feet; vacuum, 26 inches; throttle
open; average effective pressure, $= \frac{19{\cdot}31+19{\cdot}38}{2} = 19{\cdot}35$ pounds.

. 4.—Taken at 5 h. 30 m. P. M., April 27th, Delaware Bay; foretop-
nd top gallantsail set; moderate breeze abaft starboard beam; revo-
s per minute, $16\frac{1}{4}$; steam pressure in boilers, $14\frac{1}{2}$ pounds, cutting
3 feet 2 inches; vacuum, 26 inches; throttle $\frac{3}{8}$-ths open; average
ive pressure, $= \frac{17+16{\cdot}75}{2} = 16{\cdot}87$ pounds.

r developed and utilized.—Diameter of wheel at centre of pressure, at 4 feet
lip, = 27·68 ft. = circumference 86·96 feet.
ward trip; distance traversed by centre of

pressure, . . .	$86{\cdot}96 \times 16{\cdot}17 \times 60 \times 7{\cdot}6 =$	641193
Actual distance traversed by vessel,	$101{\cdot}3 \times 5280 =$	534868
Slip = 16·58 per cent.	=	106325

d trip; distance traversed by centre of pressure,	$86{\cdot}96 \times 16{\cdot}50 \times 60 \times 8{\cdot}13 =$	700194
Actual distance traversed by vessel,	$102{\cdot}8 \times 5280 =$	542788
lip = 22·48 per cent. (Head winds for one-half distance.)		157406

, if the deduction for the effect of wind (before alluded to) be
, the slip in still water would be 16·44.

an slip on both trips $\frac{16{\cdot}44+16{\cdot}58}{2} = 16{\cdot}51$ per cent.

d mean speed " $\frac{13{\cdot}33+13{\cdot}66}{2} = 13{\cdot}50$ stat. miles per hour.

erage power developed in the same time was

$\frac{\times 20.1 \times 16{\cdot}28 \times 8 \times 2}{33000} = 652{\cdot}69$ horse power; or allowing $1\frac{1}{2}$ lbs. per
. on piston for working engine, and 5 per cent. on the remainder for
n of load, we find $= \frac{4114 \times 18{\cdot}6 \times {\cdot}95 \times 16{\cdot}28 \times 16}{33000} = 573{\cdot}66$ horse
r transmitted through the shafts; which at $86{\cdot}96 \times 16{\cdot}28 = 1415{\cdot}7$
er minute (velocity of wheel) becomes a pressure tangential to the cir-
erence, of 13451 pounds. From oblique action of floats, (causing
of 17·5 per cent. at 4 feet $4\frac{1}{2}$ inches total dip,) this is equal

a pressure available in propelling in a line parallel to the keel, of 1097 pounds, which is the resistance of the vessel at a velocity of $\frac{415\cdot7\times\cdot835}{60}=19\cdot7$ feet per second.*

Hence, coefficient of vessel $=\frac{11097}{(19\cdot7)^2}=28\cdot60$, at this speed and in still water.

The proportion of total power utilized in propulsion is as 652·69 : $\frac{1415\cdot7\times\cdot835\times11097}{33000}=652\cdot69 : 397\cdot47$, or as 1·00 : 0·609, or nearly 61 per cent.

CONSUMPTION OF FUEL.—Good Buck Mountain, (anthracite.)

An accuráte record of coal used, was kept during the trip. From the time of leaving the wharf to the time of returning to it, there were consumed 398 buckets, each weighing 103 lbs. = 40994 lbs.; of this it is supposed that 1000 to 1500 lbs. was used in banking fires at the Breakwater, from 8 P. M. to 6 A. M., April 28, and in raising steam; that being a matter of uncertainty, however, may be neglected, and we find for the consumption $\frac{40994}{21\cdot3}=1922$ lbs. per hour; 21·3 hours being the whole time during which the engine was working.

EVAPORATING EFFECT.—

Average point of cutting off, . .	3 feet 2 inches of stroke.
Clearance at each end of piston, . .	1·25
Space in each nozzle and steam chest, .	2
Total admission each single stroke,	3 " 5·25 inches "

Then volume of steam used per minute, $=3\cdot4375\times2\times16\cdot05\times28\cdot$' $=3120$ cu. ft.; average pressure, (see table,) 20·10 pounds, of whi volume $=827$, so that

$$\frac{3120}{827}=3\cdot772 \text{ cu. ft.}\times62\cdot5=235\cdot75 \text{ lbs water evap. per min.}$$

and $\frac{1922}{60}=$ 32·03 lbs. coal used "

$$\frac{235\cdot75}{32\cdot03}=7\cdot360 \text{ for fresh water.}$$

For about one-fifth of the time (at sea,) the water was maintained

*A convenient formula embodying this calculation is,

$$C=\frac{A\,P\,L.\,\sin.\,^2\delta}{\cdot0043\,D^3\,R^2\,(1-s)^2}$$

When C = coefficient of vessel.
A = area of cylinder in inches.
P = pressure in cylinder effective for propulsion, after deducting for engines and friction.
L = length of stroke in feet.
... of wheels at centre of pressure in feet.

which at a temperature of 110° feed water, and 260° in the boilers, causes a loss of 16·9 per cent. in the whole amount, during one-fifth the time, or for the whole time, $\left(1+\frac{16 \cdot 9}{83 \cdot 1 \times 5}\right) \times 7 \cdot 360 = 7 \cdot 660$ lbs. water to a pound of coal.

No foaming was observed in the boilers during the trip.

For the Journal of the Franklin Institute.

Explosion of the Steamer Redstone. By Thomas Bakewell, Esq.

To the Committee on Publications.

The steamer *Redstone*, on which the explosion occurred, was a new boat, built at Brownsville, Pa., with three boilers, 42 inches diameter, and two flues, each 15 inches diameter. She plied as a packet between this place and Madison, 100 miles below, and was owned by parties in that place. The explosion happened 12 miles this side of Madison.

I have annexed the answer to my letter of inquiry to Mr. Sopher, the Clerk of the boat. The Captain may in a few weeks be able to visit this City, when I shall not fail to see him.

You will please observe that Mr. Sopher states that "the opinion of Captain Pate was, that the water must have been too low." This "opinion" arises not from any facts justifying it, but is a sample of the prevailing idea, that boilers cannot burst with plenty of water.

There can be no question in this case, that the accumulation and retention of steam under the constant expectation of being able to "go ahead," and then the prolonged delay of the engine hanging on the centre, was the cause of the explosion.

I enclose a newspaper account of the explosion of the *Redstone*, and also that of the *Glencoe* at St. Louis, giving the *testimony* of an assistant engineer, (say opinion of himself and friends,) as to the cause. This newspaper slip of the St. Louis explosion was shown to me as the strongest case known, conflicting with my views of explosion, viz: that boilers burst simply from excess of steam, and that want of water contributes only so far as the metal may be heated and weakened thereby; that in no case of water on a heated part of a boiler, can steam be generated in quantity so suddenly as to explode the boiler, without previous indications by the safety valve, or any approach to it, although steam *may* be generated from that or other cause more freely than the safety valve will *continue* to discharge under its usual weight.

The very disastrous explosion of the boilers of the *Moselle* at this place in 1836, was followed by the usual newspaper statements and verbal gossip, of want of water, boilers red hot, hydrogen gas, &c.; and persons were ready to testify to pieces of the boilers being red hot, as they flew through the air.

The boilers, as arranged in the boat, side and side, about 3½ inches apart, are connected near the fire end by a double concave cast iron washer, 7 inches diameter, with a hole in the middle, 2 inches diameter, to meet corresponding holes in the boilers, for a water passage, the joints between each side of the washer and boiler being made with lead. This

She took in tow at the time a loaded corn boat, containing ab bushels, for Carrollton, a distance of 12 miles, and made it in t time, say one hour and thirty minutes. After leaving the corn landed at the wharf, and remained fully ten minutes, taking passengers. We then got under weigh, and after running 3½ mil ed at Scott's Farm, on the Kentucky shore, where we took on Perry A. Scott.

At the time the wind was blowing hard ashore, and instead of out as usual, she only commenced backing down the shore, the venting. The Captain then gave the order to stop backing, and on the starboard wheel, that being the wheel next the shore. I going ahead, the engine "caught on the centre," and whilst the was working the levers, two of the boilers exploded.

I am unable to say how much steam we had on at the time, bu carried 140 pounds, and have had as high as 170 pounds, which most I have ever known. Nor can I tell you any thing in rega water, as the first engineer of the watch was killed. The opinion Pate was, that the water must have been low.

Aurora, April 30, 1852.

Extract from the Newspaper Account:

The question naturally arises as to the cause of the explosion notorious fact, that she has been "shoved," and in for a race, she came across another steamer, making it a rule to pass h weigh if possible. The following paragraph from the Madison Saturday tells its own tale:

"The steamer *Redstone* came in last night with some eighty p and a fair freight list. The *Redstone* is one of the fast *ones*, as t steamer *Buckeye* found out yesterday, after laying out in the rive for her. The *Redstone* took her on the wing—passed her und

dying declarations in relation to the explosion of the boilers of this ill-fated boat. Yesterday noon we met with two brothers of the deceased, who were present when these disclosures were made, and from them glean the following facts, in substance the same as said by Ryan on his death-bed.

A short time previous to his death, Mr. Ryan called those into his room, among whom were his two brothers, residents of Alton, Mr. Samuel Rogers, a respectable brass founder on North Main street, and others, and told them that he desired to make a statement previous to his death, which he felt assured was near at hand.

He then went on to state that, on the evening of the arrival of the *Glencoe* at this port, himself and George Buchanan, first engineer of the boat, were on watch. Some time before reaching port, he (Ryan) tried the water in the boilers, and found it very low, and called to B., and informed him of the fact, and received some evasive answer. He again tried the water, and again called to Buchanan, who told him to mind his business, that there was water enough in the boilers, and he would take her with it to St. Louis or to h–ll.

Not satisfied, Ryan expostulated, and Buchanan told him in substance that it was his (Buchanan's) watch, and that he (Ryan) had nothing to do with pumping up, and, moreover, that if he (Ryan) had his way, he would have the water from the boilers running out at the tops of the chimneys. Subsequently Buchanan remarked that the boat was making good time, and he would take her into St. Louis kiting. This was perhaps the last remark made, and when the boat reached the wharf, and commenced trying to effect a landing, Buchanan turned on the gauge-cock, and let on the water. The instant the cold water came in contact with the heated boilers, now nearly dry, the explosion took place.

This statement was made, we understand, over three or four times, at the solicitation of the dying man's friends, who thought, perhaps, his mind was wandering. He was told the weight and importance of his declaration, and was asked if he was not out of his right mind; to which he replied, that he was perfectly conscious of what he was saying and doing; that his declaration were facts, and that he designed making the same statement in the event of his recovery, and now that he felt conscious of his approaching end, he was the more anxious to unburthen his mind. In a short time after, Mr. Ryan breathed his last.

We give the facts substantially as related to us, without exaggeration. Comment is unnecessary, the declarations speak for themselves.

St. Louis Intelligencer, April 9.

For the Journal of the Franklin Institute.

Explosion of the Steamboat "Mary Kingsland." By A. C. Jones, Eng'r. (*With a Plate.*)

To the Committee on Publications.

On February 29th, 1852, at 6 o'clock, A. M., about 30 miles below New Orleans, the tow boat *Mary Kingsland* exploded the starboard middle boiler. She had in tow, a ship, a barque, two brigs, and a schooner, and

was running steadily at the time of the explosion. Eight persons died from injuries received, and much damage was done to the boat and engine.

The *Mary Kingsland* was originally a ship, which was burned to the water's edge, and since being converted into a tow boat, has had three explosions on her,—one about a year since, after which four of the six boilers were replaced with others, the one marked *a*, (Plate VIII.,) and the one now destroyed being the old ones; their after heads are *half* cast iron. These two have a water space between the flue and shell of 3½ inches; the others have only a space of *one and a half inches.*

The diagram gives the position of the iron fragments of the boiler and its appendages. As the force of the explosion was upwards and aft, of course much of the woodwork is destroyed. *b* is the foremast, *c* is a large piece of the shell, flattened and partly doubled up; many fragments of the front cast iron head is attached to it; *d* is the two starboard boilers, bottom upwards, the chock joint (forming the water connexion between them) being in good order. Above the other boilers, at *e*, is two-thirds of the steam drum, and its steam connexion pipe; all the joints have been torn from the tops of the boilers. Forward of this, on the top of the fragments of the boiler deck, is an upper section of one smoke pipe, uninjured; at *f*, on the main deck, is the other smoke pipe, in good order. The breechen of these pipes is only partially injured. *g* is part of the standing pipes, through which the supply of water from the pump passed to the boilers; *h*, a piece of flue, (round,) much torn at one end; the other end has nine-tenths of the holes in good order. *i*, is a straight flat piece of the shell, the widest part being 23 inches; this piece is nearly a foot longer than is due to the perimeter of the boiler. Near this is a piece of flue, *k*, about 18 inches long, with some fragments of the front cast iron head attached to it. About eight feet abaft this, *l*, is half of the cast iron front head of the boiler; all the holes in the rim are in good order. About ten feet further aft, we come to the principal part of the boiler, its after end resting on the paddle wheel shaft. Fig. 2 gives the shattered appearance of the end, both the cast and wrought iron part of the head being much ruptured. Ten feet of this shell retains its cylindrical form, except a large flattened piece, which stands out at a tangent from it. The shell is much corroded, and there are two large patches on the bottom, and a small one on the side. The iron is much laminated, and appears of a very bad quality. The highest water line inside shows that this boiler had been worked with *the water just covering the flues;* one gauge cock is two inches above the line of the flue tops, and the other one and three-quarter inches above it. What had been the inboard flue, *m*, is collapsed its whole length, 18 feet; the other flue, 17 feet 6 inches long, is cylindrical; half the rivets at its end are cut clean off, and remain in the holes; another part has a piece of flue sheet torn off outside the rivets; *n* is a piece of flue unchanged in form, 8 feet 6 inches long, having a hole in its side, about the size and shape of a man's hand; this piece of flue is exactly at right angles to the part of the flue in the shell, and singularly, the end *o* belongs to the end of the flue still fast to the head of the boiler. At *p*, under the flues, lies the manhead in a perfect state.

New Orleans, April 2, 1852.

Explosion of the

MARY KINGSLAND.

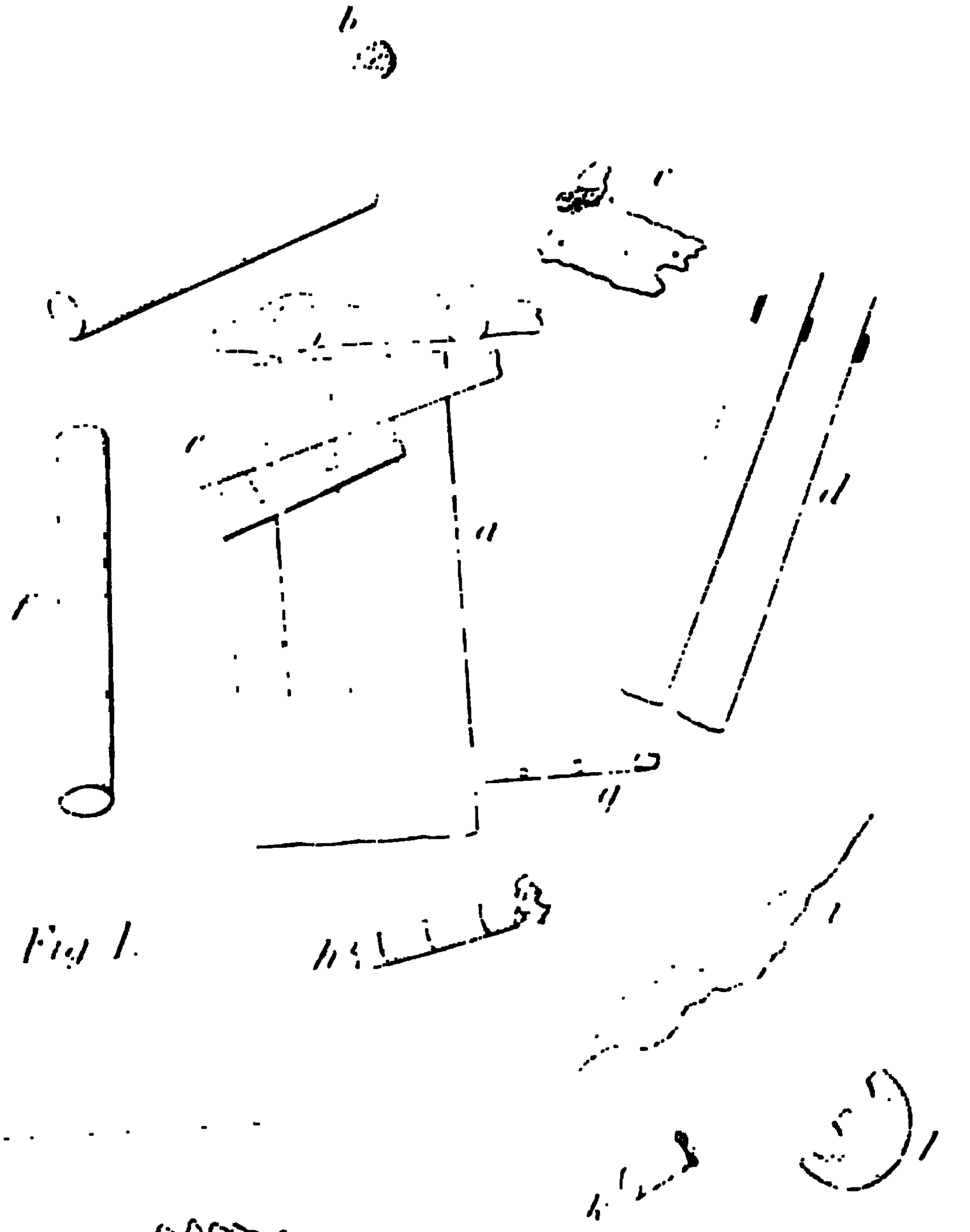


Fig. 1.

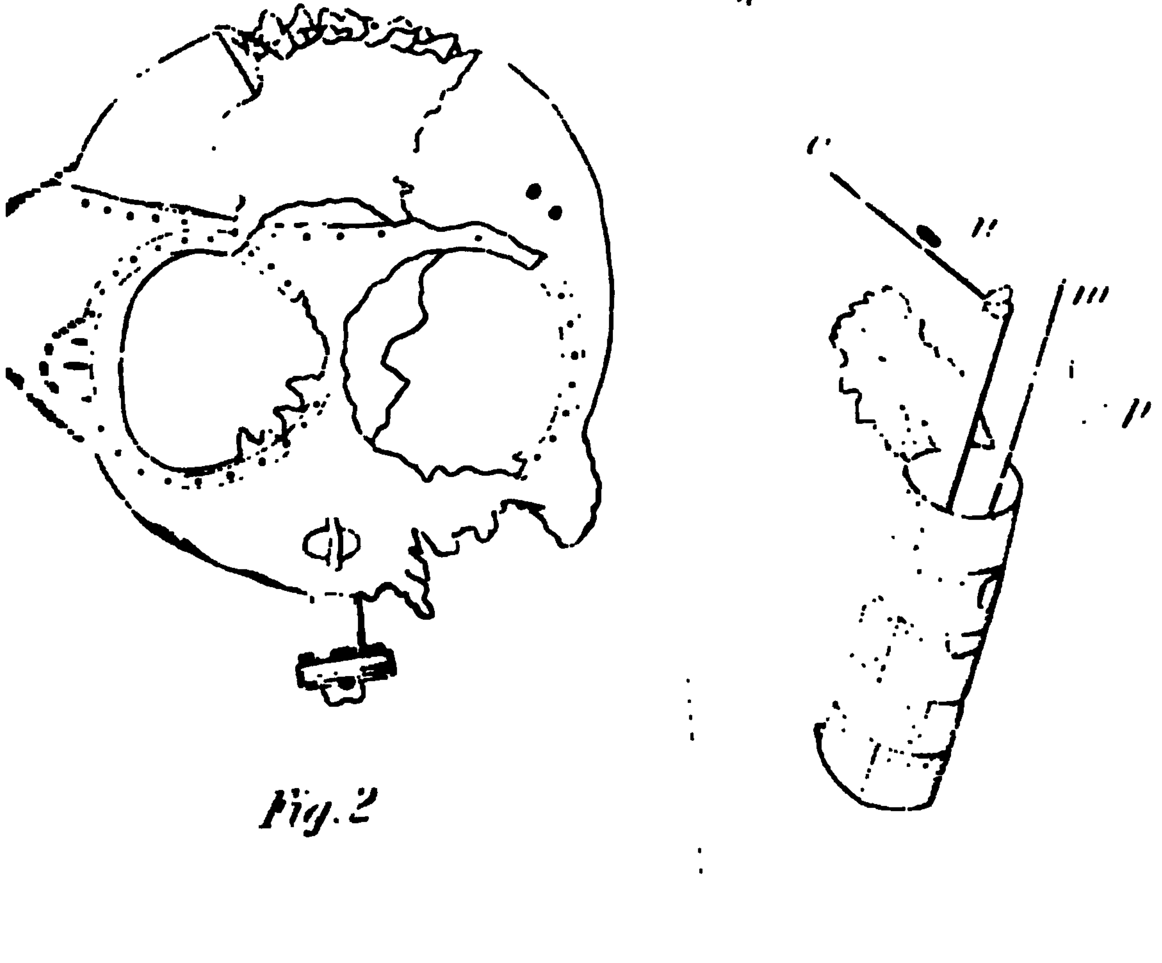


Fig. 2

For the Journal of the Franklin Institute.

On Marine Propulsion. By J. V. Merrick.

s from the last "Reply" of Mr. Nystrom, published in the r, that he is still unable to understand the true theory on the ı. Possibly this might not have been the case, had he read what he professes to criticize; in which ease he would not lled me to notice one or two instances of misrepresentation, vidently the result of carelessness in reading.

passage to be noticed reads as follows:

Mr. M.'s lengthy disquisition, "that slip is no loss of effect," he comes to of my first formula: $p\ v = r\ s$, or, as Mr. M. expresses it, $p : r = s : v$, in

ent of the vessel.
' floats multiplied by the coefficient for resistance to plane surfaces.
y of the vessel.
y of the water backwards (slip).
oof that slip is *no* loss of effect. The effect delivered from the steam engine useful effect.
. has embodied the formula, he condemns it as wrong, and says it should

d substituted *resistance* of the vessel instead of *coefficient*, it would have But this "coefficient" makes the remainder of his article wrong."

'strom will turn back to his own article in the March number, will find the following notation, which precedes the equation upon:

ean thrust of dynamometer in pounds;
sistance to the propeller in pounds," &c., &c.

then read again the definition given of the term "coefficient," foot of p. 272,) and the examples given to illustrate it in the *San Jacinto*, he will see that (the same notation being adopt-, when C = coefficient of the vessel, and v its velocity, and are simply convertible terms, since the resistance of the pro-unds is precisely the same as that of the vessel in pounds; in , the 12,815 pounds measured by the dynamometer of the , expresses either the pressure of the propeller backward water, or the resistance opposed by the vessel at the velocity was moving forward—one of the very *elementary* principles in

nption, therefore, that I have first condemned and then em-Nystrom's formula, is entirely gratuitous.

substituted, as he suggests, the term, *resistance* for *coefficient*, been correcting (?) that which was right before.

the course of his remarks, Mr. N. indulges in some facetious respecting "square radius," and "square degrees," based graphical omission in the text; for a correction of which he is he "Errata" in the May number. Notwithstanding this omis-sult obtained was correct, as a little calculation would have

nnexion it may be remarked, that although the projected area *acinto's* propeller was inadvertently misquoted, an examina-

tion of the context will show what was *intended.* The error affected only that particular case, and not the principle involved; showing only that a higher coefficient for the resistance of plane surfaces obtained in that instance, than ·845, which was therein deduced. The true coefficient was 2·347.

But to prolong this discussion will be of little avail: the arguments, *pro* and *con*, are before those who take any interest in the subject. I shall, therefore, conclude what I have to say, by showing to Mr. Nystrom the fallacy of the argument on which he relies for proof—an argument on which he appears to have expended a vast number of figures and equations.

To demonstrate this point, we have only to examine the diagrams by which the argument is illustrated.

We there find that a fulcrum, which has always been supposed to be a point of support for the action of the power, in propelling a vessel as well as in moving any other resistance, is an imaginary point in the area of a paddle wheel, situated somewhere between the shaft and the immersed float—the position of this point being determined merely by the ratio between the advance of the vessel and the slip. This is a very convenient (for the argument) and quite original method of viewing the lever. There is only one trifling circumstance overlooked, which is, that the "fulcrum" moves over space in the same direction and with the same velocity as the resistance.

To those who are content with the old method of considering the lever, it is easier to suppose that the fulcrum is in the water; that this fulcrum recedes a certain proportion of the whole movement due to the power; and that the resistance is moved over a space equal to the difference between these two spaces: in other words, that the arm of a paddle wheel is to be judged of precisely in the same manner as the arm of a locomotive driving wheel.

For the Journal of the Franklin Institute.

On the Comparative Value of Anthracite and Bituminous Coals for the purpose of Generating Steam.

Congress has recently called on the Secretary of the Navy for the report of the Engineer in Chief, Charles B. Stuart, Esq., on the comparative value of the two different kinds of coal for the purpose of generating steam. Some years since a large number of experiments were made by Professor Walter R. Johnson, from samples of coal furnished by miners, all of which were published by authority of Congress; and in consequence of the result of those experiments, the naval steamers have been supplied with Cumberland coal, very much to their injury and expense.

The only true test of the comparative value of coal is to take the two kinds as they are delivered at your ship, stowed in the bunkers, and brought out at your boilers ready for use. The anthracite will undergo all this without change, while the Cumberland, from its friable nature, becomes reduced almost to a powder.

The experiments of Mr. Stuart are from two lots of coal delivered at the New York Navy Yard, and the contents of the large stone dock at that station have been several times pumped out with each kind. The result has not yet been made public, but it is understood that the anthracite is about 50 per cent. cheaper than the bituminous, the difference in cost of each per ton being considered.

Many of our naval engineers have for several years past been strongly in favor of anthracite coal, owing to the very great trouble of getting any Cumberland suitable for steaming. The steamer *Fulton* is fitted for anthracite; the *Saranac* recently took in 150 tons of it at San Juan de Nicaragua, and her engineer prefers it to bituminous; the *Mississippi* now has 300 tons in her bunkers, for her next cruise; and, in fact, the general feeling is in its favor, and this feeling is in a great measure caused by the want of mechanical strength in the Cumberland coal, to withstand the necessary handling before it reaches the furnaces. In this respect the Cumberland is inferior to most coals of that class, particularly the English. The *City of Glasgow* burns Cardiff coal on her trips to this port, and is enabled without difficulty to carry a fair pressure of steam. On her return, she burns Cumberland, and cannot make steam sufficient even with an increased supply of fuel.

In addition to the economic value of anthracite coal, it is entirely free from all danger of spontaneous combustion. B.

For the Journal of the Franklin Institute.

On Ericsson's Caloric Engine.

Messrs. Hogg & Delamater, of New York, are constructing for and under the superintendence of Captain Ericsson, a pair of very large caloric engines, intended for a vessel of about 1900 tons, and every possible exertion is being made to have her ready for sea in September. It is not my purpose to discuss the merits of this engine at the present time, deeming it sufficient to say, that after many years of active exertions, Captain E. has at last perfected to his own satisfaction and that of his friends, his caloric engine. It has been fully secured by patent in this country and in Europe. A model engine of 60 horse power has been in operation at the works of Messrs. H. & D. for months past, and it has been repeatedly tested to their entire satisfaction.

The machinery for this vessel will be a pair of engines, one abaft the other, in line with the keel of the ship. Each engine has two cylinders (single acting) of the diameter of 14 feet, with 6 feet length of stroke. To each engine there is one beam, and the connecting rods from both engines take hold of the same crank-pin, but from the position of the engines, both are not on the centre at the same time. There are two air pumps to each engine, for forcing the proper quantity of air into the receiver; their diameter is 137½ inches, and stroke same as that of the cylinders, directly over which they are secured. The pistons of the two are connected together by several rods, and it is from the lower side of the air pump piston that the power is communicated through the beams to

the cranks, on the shafts of which are side wheels, about 32 feet diameter, and 8 feet face.

Should the practical operation of this ship prove successful, 100 tons of coal is expected to do the work of 1000 tons in the steam engine, and the advantages that would accrue to the world cannot be estimated.

For particulars of the patent, see *Journ. Frankl. Inst. vol.* xxii. 228.

B.

For the Journal of the Franklin Institute.

Notice of the Naval Dry Dock and Railway at Philadelphia.

The United States Dry Dock at this port having recently been completed, was successfully tested during the past month by the lifting and hauling out of the steam ship *City of Pittsburg*, of 2200 tons burthen This Dock and appendages being the largest in the world, merits more than a passing notice. The lifting power consists of nine sections six of which are 105 feet long inside, and 148 feet over all, by 32 feet wide, and 11½ feet deep; three of them are of the same length and depth as the others, but 2 feet less in width; the gross displacement of the nine sections is 10·037 tons, gross weight 4145 tons, leaving a lifting power of 5892 tons, which far exceeds the weight of any vessel yet contemplated. The machinery for pumping out the sections consists of two engines of 20, and two of 12 horse power. In connexion with the sections (which form the lifting power of the dock,) is a large stone basin, 350 feet long, 226 feet wide, and 12 feet 9 inches deep, with a depth of water of 10 feet 9 inches at mean high tide.

At the head of this basin are two sets of ways, each being 350 feet long, and 26 feet wide. These ways are level, and consist of the bed pieces, which are three in number, and firmly secured to a stone foundation; the central way supports the keel, while the side ways receive the weight of the bilge; these ways are of oak, and are finished off to a smooth surface. On the top of the bed pieces or fixed ways, comes the sliding ways or cradle, which are also 350 feet long and 26 feet wide, so constructed as to admit of being adjusted to the length of any vessel.

The operation of the dock is as follows:—The sections are sunk so as to allow the vessel to be floated in; as soon as she is secured in the proper position, the pumps are put in operation, when the sections begin to rise, and as soon as they come to a bearing on the keel, the bilge blocks are run in until they fit the ship. When all is secure, the sections are pumped out until the keel is some two or three feet above the water. If repairs that will only require a short time are contemplated, the vessel is kept on the sections, and no other portions of the dock used. But the *Pittsburg* was taken up for the purpose of testing the several parts of the dock, and after she was lifted out of the water the sections carrying the ship were floated into the basin in line with one of the sets of ways. When this is accomplished, the sections are filled with water, and rest on the bottom of the basin, which is of stone. Bed ways are now laid on the sections in line with those before mentioned. When they are secured they are greased, and the cradle is now slid under the ship, and she is

blocked up on the cradle, and the blocks on the sections are removed. At this point of the operation a new instrument of power is brought forward for the purpose of hauling the ship from the sections on to the bed ways in the Navy Yard. It consists of a large hydraulic cylinder, having ram of 15 inches diameter and 8 feet stroke, and a power of 800 tons. On the top of this cylinder, and attached to it, are two vertical direct cting engines, with cylinders 16 inches in diameter and 16 inches stroke, onnected at right angles to one shaft, on which are four eccentrics for orking four hydraulic pumps of 1½ inches bore, and 6 inches stroke; e tank which carries the water for the press is also on the top of the linder, and forms the bed on which the pumps are secured. The boiler hich supplies these engines with steam, is on a sliding cast iron bed ay, some 12 or 15 feet ahead of the hydraulic cylinder, and connected it by two cast iron rods. This boiler is of the usual locomotive form, d has 85 tubes of 2 inches diameter, and 9 feet long. To get ready r operation, the hydraulic cylinder is slid down to the edge of the basin, s ram is run in, and a connexion made by means of two side rods of rought iron from the cross head of the ram to the sliding cradle which rries the ship. The central bed way has key holes mortised through it orizontally, every 8 feet, and there are projections from the hydraulic ylinder, which have corresponding key holes in them. Two cast iron eys, 24 inches wide, and 6 inches thick, are slid through the key holes n small wheels; these keys secure the cylinder to the central bed way; e engines and pumps being now put in operation, a pressure is brought n the 15 inch ram, and as soon as the pressure overcomes the resistance, e vessel must move. The estimated weight of the *Pittsburg* was 800 tons, exclusive of the sliding ways and blocking; the power required to start this weight on a level, greased surface, was 250 tons. s soon as the vessel has been moved 8 feet, the keys which hold the ylinder to the central way are withdrawn, and by means of a screw hich is attached to the head block of the ram, and driven from the ngine, the cylinder and boiler are in their turn rapidly slid ahead, (the ater in the cylinder being allowed to escape into the tank,) when the ast iron keys are again slid in place, and the vessel moved another 8 eet. After the first starting of the *Pittsburg*, the power required to emove her was but 150 tons, and she was moved 260 feet in 6 hours. To push the vessel off, the cylinder and appendages are moved to the ead of the ways, put on a turn-table and reversed, when it is gain brought down to the cradle, and the cylinder being secured as beore, the head of the ram is applied directly to the cradle, and the vessel moved back on to the sections, which requires the same time and power as haul them off. In docking and hauling out the *Pittsburg*, every art of the work gave the most entire satisfaction, no portion showing e least defect, and the time required to go through the various operaions being less than was expected. But six sections were used for lifting this operation, leaving three unemployed. It will at once be een that the capacity of this dock exceeds that of the stone docks at New York, Boston, and Norfolk, combined, for united they can take but hree vessels, while here, two of our longest war steamers may be hauled out n the ways, and two frigates lifted on the sections. The advantages that

must result from the facilities of repairing a vessel elevated into light and air over one sunk in a stone dock, are very great, and have only to be seen to be appreciated. I am indebted to the work on Naval Dry Docks, recently published by Chas. B. Stuart, Esq., Engineer in Chief, United States Navy, for many of the details of this article. B.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, May 20, 1852.

Thomas Fletcher, Vice President, in the chair.

Owen Evans, Recording Secretary, *Pro. Tem.*

The minutes of the last meeting were read and approved.

Letters were read from A. Vattemare, Esq., Paris, France; The Zoological Society, London; and Prof. A. D. Bache, Coast Survey, Washington City, D. C.

Donations were received from The Minister of the Interior, Agriculture, and Commerce, of France; The Zoological Society, and The Chemical Society, of London; Prof. A. D. Bache, Coast Survey, and The Smithsonian Institute, Washington City, D. C.; Hon. Joseph R. Chandler, S. G. Haven, and John Robbins, Jr., Members of Congress; Charles B. Stuart, Esq., Engineer in Chief, U. S. Navy; John P. Whipple, Esq., Engineer, U. S. Navy; William J. Lewis, Esq., San Jose, California; Dr. T. S. Kirkbride, Seth Craig, Esq., Dr. L. Turnbull, and Dr. C. M. Wetherill, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of April.

The Board of Managers and Standing Committees reported their minutes.

The Special Committee on the Law for the Ventilation of Buildings, presented their report, and were discharged.

New candidates for membership in the Institute (6) were proposed, and the candidates (6) proposed at the last meeting were duly elected.

Dr. Rand exhibited some further specimens of Hyalotypes, taken by the Collodion process, by Dr. C. M. Cresson, to which he had called the attention of the members at the last meeting. By the addition of bromine the sensibility of the film had been much increased. The pictures exhibited were taken in from six to thirty-two seconds in diffused light, in one-quarter and one-half seconds in the open air.

Dr. Wetherill brought forward a piece of water pipe which had been buried and in constant use in this city for 24 years, and showed but a slight incrustation of oxide. He had found the coating, on analysis, to consist of a mixture of protoxide and sesquioxide of iron, with traces of silica, carbonate of lime, and magnesia, and fourteen per cent. of volatile matter.

Mr. Graff remarked that in certain cases in Boston and New York, the oxidation of the pipes was very rapid, while with us it was usually slow. Some discussion arose on the causes of this discrepancy, and the mode of protecting the pipes.

Dr. Turnbull exhibited a map of the telegraphic lines in the United States, and gave a history of the progress of telegraphic communication in this country.

Dr. Rand further exhibited a drawing, which he had received from Mr. Bartol, of the fracture of the centre shaft of the Steamer *Hermann*. The shaft broke square off between the crank and journal. That portion which is white in the annexed cut is the part of the shaft that was solid at the time of the fracture; the black portion was very much discolored by oil and dirt, and had evidently been cracked for some time.

Mr. Henry Francis presented a specimen of glazed sheet iron ware. Mr. Francis remarked that he was about to commence the manufacture of this ware on a large scale in this city.

Mr. J. V. Merrick exhibited a specimen of the new wrought iron tube for external pressure, manufactured by Thomas Prosser & Sons, in New York. This tube is joined mechanically and without brazing or welding, dependence being had for tightness under pressure on the previous preparation of the edges. It was stated that this tube had been applied in several boilers in England, and recently in New York, giving satisfactory results. The advantages claimed for it were the increased strength and diminished probability of corrosion, owing to the preservation of the *surfaces* of the original boiler plate from which the tubes were made, which, in the old plan, are abraded by passing through dies.

He also called the attention of members to specimens of compressed fuel, supposed to be a conglomeration of powdered bituminous coal, tar, and clay, which had been brought from England by the Steamer *City of Glasgow*, and still retained nearly its original form after passing through the coal bunks.

BIBLIOGRAPHICAL NOTICES.

Memorial of Alfred Guthrie, *a Practical Engineer, submitting the Results of an Investigation made by him into the Causes of the Explosion of Steam Boilers.*

To a person who has not made himself practically familiar with the steam engine and its applications, it must appear very singular, that there is such an irreconcilable diversity of opinions set forth by writers on the subject, not only as to the best method of using this power, but particularly as to the dangers accruing in its use, and the best modes of avoiding these risks. Especially would it appear strange to one, familiar with the study of science, that in a matter so exclusively physical, recourse should be had so continually to the most mysterious agencies, to account for the terrific explosions with which almost every electric wave from the west comes loaded. The reason for these anomalies is, however, easily to be found by the searcher, in the rapid advance of the use of steam power in our country, which has so far outrun the power of our

population to supply it, especially in the West, where labor is in such demand, and the competition in business is so great, that the place of engineer in charge of a steamboat, including as it does, the responsibility for the lives of hundreds of passengers at a time, is frequently, indeed most frequently intrusted to persons, who are in no wise fitted either by previous education, or by mental or moral habits, to be entrusted with such responsibilities.

When under such inefficient administration, the proper precautions are neglected, and an explosion ensues, it becomes necessary to find some explanation for the phenomena, which shall not point to a fault, on the part either of the builders of the engine and boat, the owners, captain, engineer, sub-engineer or hands; and so electricity, the spheroidal state, magnetic repulsion, are taxed beyond their powers, and each novelty in science is necessarily grasped at to account for these fearful phenomena, to the investigation of which, according to the laws of common sense, no law of the United States, nor any officer of state or county is competent.

Many years ago, at the request of the U. S. Government, the Franklin Institute appointed a committee to investigate the causes of explosion of steam boilers, and the means of preventing such accidents, which committee made a report which has become classical in this branch. Since that, we have had nothing on our side of the Atlantic sustaining the principal and satisfactory views here expressed, until the memorial to Congress, whose title stands at the head of our article. Here, however, we have the production of a practical steam engineer of Chicago, who has devoted a considerable portion of time to the investigation of this very interesting matter, and whose results are precisely in accordance with those before arrived at by Messrs. Bache, Reeves, and others of the Franklin Institute committee. Mr. Guthrie in his very able pamphlet, handles the subject in an entirely practical way, and rejecting all mysterious agencies, attributes the explosion of the steam boilers of our Western boats— First, to the faulty materials or faulty construction of boilers; secondly, to badly arranged relations between the power of the engines and the resistance of the boats; thirdly, to the neglect of those in charge, either in permitting the elastic force of the steam to increase beyond the cohesive resistance of the boiler, or in permitting the water to become low, and thus to present a heated surface of metal, which, under certain circumstances, is necessarily followed by a tension of steam which no boiler shell can withstand. This branch of the subject is of such importance that we shall make no excuse for presenting to our readers a portion of Mr Guthrie's remarks and illustrations of the subject, which we do the more gladly, as they will well express our own views on this subject, in opposition (practically) to the remarks on this subject by an esteemed correspondent in the present number of the Journal, page 413.

"Explosions produced through the *gradual increase* of steam within the boiler, probably, are not of as frequent occurrence as from other causes; yet, explosions have undoubtedly occurred from this alone, and as yet nothing has been introduced to prevent the same occurrences from the same cause. By far the greater proportion of explosions are produced by a *sudden* increase of steam beyond the ability of the safety-valve to relieve, or the powers of the boilers to resist, and almost always occur-

within a minute or two after starting the engine. These facts are well wn to all who have in any manner inquired into these subjects; they so well known as to require no proof in confirmation of them.

In order more fully to explain the cause of this, I must refer to plate 2. 2 represents a boiler in which the water has become low, no matter ı what cause. It will be seen that the top of the flues have become ɔvered, and the water receded down to the middle of the flue; the : is supposed to be lying at her landing, with steam up ready to start; fire passes along on the under side of the boiler, and returns through flues. As shown in plate 4, it will be apparent to any one that the ; will be heated on the top just in proportion to the intensity of the e urged through them; the sides of the boiler above the water line also be heated in like manner, as far up as it is allowed to reach. posing this to be continued until all these parts are at a red heat, so as there is no escape of steam from the safety-valve, or to the engine, surface of the water remains nearly smooth, apparently unagitated; the instant an escape is opened from any cause, the water is set in ɛnt commotion, forming air or steam bubbles and froth, with a tend- always to follow the discharge of the steam overcoming these heated ıces, and augmenting rapidly the volume of steam in the boiler, fall- short of or exceeding its powers of resistance, as may be.

It is the case frequently, when water is low, that it can be found in the ȝe-cock, simply by surging or lifting the safety-valve, in consequence ıe tendency of the water and steam to rush towards the discharging ıt.

I will now suppose a steamboat as lying at her landing, water low in boilers, the flues uncovered, and heated to a red heat; the steam has ı prevented from escape, and gradually increased in density until it or near the exploding point—perhaps designedly by the engineer, he most reprehensible design of making a great display on leaving port. It is often that this condition of things is produced by the en- er, for no other motive than that of passing up and down before a ı merely in wanton display, and sheering close along the shore, in r to augment the swell and attract attention. It should be remem- d, that although this "may be sport" to the engineer, it may terminate ɔmething worse to the passengers. However, we will suppose this of things is existing. Now, if the engine should be started, the careened, or, by any casualty, water should be thrown upon these ed surfaces, it is as plain as that two and two make four, that steam be generated; and if that should be more rapidly than the safety-valve discharge, an *explosion must follow*, unless the boilers are strong enough ɔnfine it.

Hundreds of instances have occurred where this state of things has not ı long enough continued, to heat a sufficient amount of surface for ɛrating steam beyond what the boiler could resist, or where there was a sufficient quantity of water thrown at a time upon these heated ɛs to make enough steam to overcome the powers of resistance of the ɛr, but where, most assuredly, an explosion would have followed but a slight addition of either. All these occurrences tend to weaken powers of the boilers, and perhaps upon the next occasion they

clusions as to the causes, and the means best calculated to preven

"It is by introducing and explaining all the facts I can gather, ed in any way with this subject, I hope to convince those who me a candid perusal, that there is no *valid excuse* for an explos steam boiler.

"I trust from what has now been said, that it would be a ratio clusion, that if we allow the water to get low in a boiler, the become uncovered, and the fire continued, the flue will become upon the upper side, and of course weakened, and as ready to the *pressure* of steam as to the effect of a sledge hammer effectu plied. At the same time it has stowed away within itself a hea it will certainly give back upon the first application of water; larger the amount of heat to be given out, or, in other words, the the surface heated, (with a sufficient application of water,) th dreadful will be the consequences. It is found by actual expe that a single cubic foot of iron heated to a red heat, is capable rating steam enough to fill the largest Mississippi boiler, with a of over five hundred pounds per square inch.

"There is, after all the advantages from the powers of these b resist intense pressures, a serious objection to their use; the flues so large a space of the internal portion of them, that it is difficult over the flue a proper head of water, affording the engineer b "leeway" in case of accident or want of care, a slight inclinatio boat, from the changing position of the passengers or freight, thr bare flue upon the highest side. This is a serious objection; but thi boiler has become so generally adopted as the best form for the waters, that it will probably remain as it now is; at least, I kno other form at all likely to supersede it.

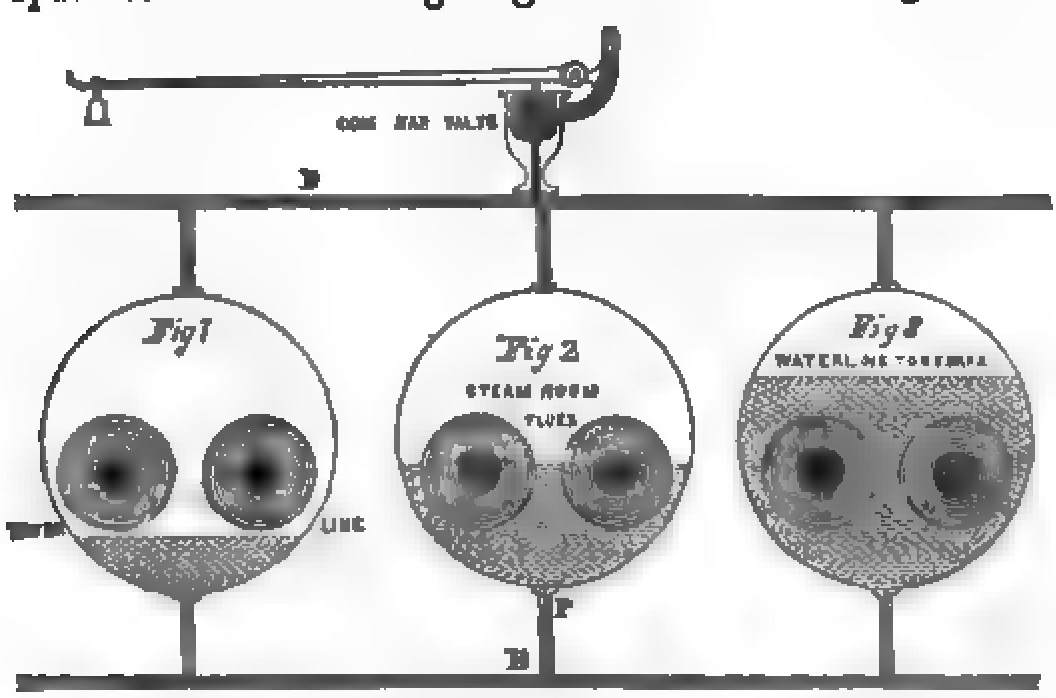
"There are instances where water was allowed to get low, an

surrounded them; even the solder with which they were united, melted and ran off like water.

"For an instant conceive the terrible consequences which would inevitably have followed, had water been suddenly applied to these red hot plates! In this instance, as soon as this state of things was known to exist, the fire was immediately drawn out, and everything cooled down as rapidly as possible; whilst the boat was kept perfectly quiet, and the safety valve not allowed to discharge any steam. As soon as the boilers had been cooled down to a safe point, the forcing pump was examined, and the difficulty corrected, when the boilers were filled up and the boat proceeded on her way."

As to the causes of this condition of things, we know no one who has as yet presented them as clearly and practically as the author before us.

"*What are the Causes of Low Water?*—In the examination of this branch of my subject, I shall find it necessary to take rather a wide scope; for, there are so many causes operating, and "*low water*" has such an important influence in producing the sad consequences more or less attendant upon all steam boiler explosions, that I must necessarily occupy a large space of this treatise in giving a clear understanding of them.



"Plate 2, showing the present Mississippi boilers with what I consider too contracted passages for water and steam; should be increased from 9 inches area say to 27 inches; the pipes changed from cast to wrought iron by all means.

"I have made the drawings, plate 2, figs. 1, 2, and 3. These represent an average number of boilers supposed to be used on each boat now navigating the western waters; these boilers are shown as standing upon and supported by what is termed the "stand-pipe," through which the water is supplied to the boilers; a very great proportion of these are made of *cast* iron, the opening for the passage of the water being only from 2½ to 3 inches in diameter; in many instances the opening does not exceed 2 inches. The stand-pipe marked B, is here purposely represented to show a very small opening, through which it is apparent that all the water must be conveyed to the boiler. Now it is a singular fact, and one, perhaps, which is not generally known, that *cold* water will hold in suspension a

greater proportion of lime than warm or hot; hence, when the temperature of the water is increased, as is generally the case in the heater, before it is sent to the boilers, the lime will be deposited first along the pipe leading to the boiler, and form there a very hard incrustation or deposite, which is very difficult to remove; this deposite will be continued as long as lime is held in suspension in the water by which the boiler is supplied. Oftentimes, in unfavorable localities, these openings will become entirely closed, and the water will of course be entirely cut off. It is this lime held in suspension which gives to water its characteristic which we denominate "hard water;" most all water contains more or less of it.

"I will raise the supposition, that the greatest amount of this deposite does not occur until after the water has passed the second boiler: it will be apparent, as this obstruction is increased, the greater will be the difficulty of water passing to the third boiler than to the second, and so on. Now if water does not readily find its way to the third boiler, of course it will be found *low* there, and probably *high* in one or both the others—showing "*good water*" in these, when in fact it is low in the third. The consequence is, the flue becomes bare and heated, and at the same time weakened, until it is sunk in by the pressure and depressed below the water—producing a rapid increase of steam, and an explosion follows; the engineer asserting, in the most solemn manner, that he had plenty of water, which may be true as regards one and two, but not of the third one.

"It may be that water so full of sediment as is found in the Mississippi, in passing to the boiler, might close this small opening as effectually as it could be done by the incrustation of lime—perhaps by a union of the two causes it would hasten it.

"Instances may occur where persons employed to clean out the boilers have taken in with them an old scrub-broom, a bundle of rags, packing, or some other material for sweeping out the mud and accumulation of sand, and forgetting or neglecting to remove it when they have got through. Suppose this, whatever it may be, settles into and fills up the passage to one of the boilers, or forms a nucleus for checking the dirt in the water, until finally it becomes closed; water then gets low, and the usual effects result. The remedy readily presents itself: *enlarge* the opening of the stand-pipe; and they should always be made of *wrought* iron, and never without an opening of six to eight or ten inches in diameter. There is no possible objection to it. Although explosions may not be brought about very frequently from these causes, yet there are undoubtedly instances where they alone have been the cause, and may do it again. Certainly, prudence alone would dictate an enlargement to guard against it.

"It may be urged that the stage of water in the boiler here described, would be indicated by the "try-cocks" in them. This is very true—*it might* be; but, in many of the boats some of the boilers have no gauge-cocks at all. Besides, an engineer might entirely neglect some one or more of the boilers, if they were furnished with them, and he was constant in his attention to the others; relying upon the hope that if water was good in one, it would be in all. I have, since I commenced the exami-

ition of this subject, passed from Cincinnati to St. Louis on a steamboat here the engineer did not in the whole passage test the water in one of e boilers; I knew the fact by putting upon the stem of the try-cock a tle mud, which must have been broken off if it had been tried.

"Although this was a middle boiler, still it should never be neglected, an obstruction might occur at the upright part marked P, and water ass freely to the last boiler.

"Another cause of want of water, is the inability of the forcing pump to ipply, from its want of capacity. If a pump should be found entirely o small to supply the boilers, it would of necessity be laid aside; but in case where the capacity was just about equal to the demand, or even little more, when all the valves were in perfect order and working all e time, it would probably be retained, and an effort made to get along ith it rather than encounter the additional expense of a new one. Now ippose, for a moment, a pump of this kind, with an engineer of the most idoubted capacity, and noted for his care and prudence, starting his igine with good water in his boilers, and should in a little time find his ater going down a very little; he might examine his pump, and remove hat he considered the obstruction; he has no means of knowing, without further trial of his pump, whether it is corrected or not, the pump being irdly sufficient to supply the demand without increasing it; he trusts it a state of doubt and uncertainty, until it is finally lost in the lower ock. He knows nothing now where the water is, but he knows it is ot prudent to go any further; yet, as all on board are anxious to get rough, he makes another examination of the pump, and finds a small ick or piece of rag that allowed the water to leak back. The pump is ow corrected, and at this moment they run upon a sand bar, or the boat stopped to take on a passenger. During this time, and no matter how iort, the water settles away still lower, and the flues are heating rapidly, itil the bell rings to start the engine. Apprehending the dreadful con-quences, the engineer complies with the order; the water is set in agi-tion, overflows the heated flue, a sudden increase of steam is the result, id a struggle between the steam and the boiler follows; the boiler is found e weaker, and gives way: the consequences are too familiar to need a petition. To make this still more plain, a pump is shown in plate 8, ith the obstruction under the valve; and a very small one will answer produce all the results described.

"The remedy suggested would first be to enlarge the capacity of the ump to double the demand for water in the boiler, and never to run a oat without two of them, that the supply may be continued even though slight obstruction might occur.

"A great and important remedy is already introduced upon many of the oats, known by the familiar term of "doctor." This is a separate engine onnected with the pumps alone, for supplying the water independent of he large engines.

"I conceive this so important an appendage to the safety of steamboats gainst explosions, that no boat, in my opinion, should be allowed to run i day without one. The value of these engines is now well understood, ind they will be likely to be adopted on all new-built boats, whilst the old ones may strive to keep along without them.

"It is well known, however, that steamboats are blown up even when supplied with the best of doctors and the most perfect arrangement of pumps, and some further remedy is required to correct any difficulty that may exist with them.

"I will suppose another case, in which, with a suitable arrangement of pumps, and with the most trustworthy engineer, water may get low, and an explosion occur where it might appear as if the engineer had really been faithful and was not much to blame.

"I will suppose plenty of forcing pumps and a moderate stage of water, the boat running along prudently, the engineer relying upon the known capacity of his pumps to fill up the boilers as rapidly as he may desire; the captain neglects to inform him that he is about to make a landing, but the bell is suddenly rung to stop. Now, it is well known that water will be lost very rapidly when the engine and all are lying still. It wastes away, notwithstanding every thing seems to be perfectly tight and sound. When the boat stopped there was a safe supply, but it begins to diminish; and on inquiry, the captain informs him that he will not be detained but a moment. There is no doctor or any pumps to supply the boiler, that can be worked by hand, and the boat lies in such a position that the large engines cannot well be started; he holds on; water is lost in the lower cock; he begins to feel much alarm, but he expects every instant that the order will come to start, and the deficiency may be made up; during this time the flues become bare and heated, and the dangers of an explosion follow. Had the captain informed him in time, he would have pumped up an additional head before landing, which his pumps would have enabled him to have done.

"These are a few among many instances that may and do often occur, where an engineer may be perfectly competent and careful in the discharge of his duties. Nevertheless, whilst all these dangers are accumulating, the passengers are unapprized of the volcano that slumbers beneath.

"Again, water may get low from *inattention* of the engineer. Supposing he may have a pump with the most ample capacity; it can hardly be expected that water can be fed to the forcing pump so equally, as exactly to meet the supply required by the boilers without any alteration. When the engine is started, we suppose the engineer to go and let on such a supply as he may think is necessary; he waits a little time, and tries the gauge-cocks, and finds he has rather too much water; he diminishes the supply a little, and sits down to await the result; in a short time he tests the water again, and finds, perhaps, that he shut off a little too much; he again adjusts it, and relaxes his vigilance. Perhaps he has been up through the night—is worn out with watching; he sits down and neglects to examine for some time; he feels "*pretty sure*" that the water is being supplied *very near* right, and it is a task to try it so often, and it is deferred until he makes up his mind that it will not do to *risk* it any longer; when, on examination, he finds, to his surprise, that water is gone in the lower cock; he hastens to the supply and turns on all the water, but during all this time a chip has found its way under the valve, or some difficulty has occurred, and instead of getting up rapidly, as he expects, it continues to decrease, and at this juncture the boat makes a landing; and now the

ater has a still further decrease by the discontinuance of the agitation, ie pump is stopped, and consequences must follow the stage of water ithin.

"It is undoubtedly the case that, in such instances, the only *safe* course) be adopted is to put down the fires, reduce the temperature and pressure as much as possible, and then fill up with water before running any azard, and such a course as prudent engineers will adopt; but the queson is, will *all* engineers adopt it, knowing it to be so?—evidences are o much against it to indulge the hope.

"Again, instances of the *recklessness* on the part of the engineer, and peraps other officers of the boat, may be with propriety introduced here. he following, however, may convey enough to show how it may occur, nd the passengers, whose safety and lives may be endangered, have no ossibility of avoiding it.

"I will suppose a strife between two steamboats: one is attemptingt o ass the other. The excitement is increased to its highest pitch. The res are urged to their utmost; the firemen are stimulated to increased xertion. The engineer, too, lends his aid to increase the intensity of ie heat; he finds he is increasing his steam, and it begins to escape from ie safety-valve; he then loads it with additional weights in the shape of renches, hammers, or anything that comes to hand, without knowing, r perhaps caring much, what effect they will have in increasing the presure of steam. The same things are passing upon the other boat; it is etermined "to pass or blow her up;" the forward boat finds that with ll the firing that can be done, the other is likely to pass; the engineer oes to the water-gauge, and perhaps finds, thus far, he has kept up a ood stage of water. He is in hopes that the other boat will not continue ie race but a short distance, or that it is but a short distance when both an part; and if he can by any means hold out until this occurs, he can ien unobserved put himself in a safe position. After looking it all over, e concludes he can stand it without *feeding any more water:* at all events, *afe or not safe*, "that boat shall never pass him alive." The other boat as anticipated this movement, and has shut off her water beforehand. This is not altogether a supposed case, but one that has often occurred, nd may often occur again.

"The passengers may very justly become alarmed, or, for all that, parake in the excitement; but it cannot be supposed they are made acquainted with the condition of things below; or, if they were, it does not remove tittle of the danger."

The inefficacy of the "mysterious explanations" is also ably shown, out we have at present no room to extract these remarks.

In reference to the excessive pressure, he remarks that the ascertained pressures vary from 140 to 200 pounds per square inch, but that in many cases there is no means of knowing either, by the engineer himself, what pressure is carried. These statements are still more startling when by reference to a calculation made by Mr. Merrick, jr., in the May number of our *Journal*, page 344, it is shewn from data, sworn to by the builders and engineers of the Western boats themselves, and for other purposes, that owing to the errors in the construction of their engines, in reference to their steam-ports and valves, scarcely more than one-half of this pressure is avail-

able in the cylinders—thus showing how the lives of the passengers are frequently risked without even the poor satisfaction of such pressures being necessary for the desired speed.

We shall probably in a future number, call the attention of our readers again to the extracts from this able pamphlet in reference to the manner in which engines and boats are built and run in the Western waters; for the present, we conclude with the simple remark, that, as was to be expected, this pamphlet, so clearly setting forth the fearful disregard to the safety of life on our waters, appears to have attracted no attention from Congress, and that it seems that we must look for a remedy, not from the laws of the Union or the State, (for the Institute has in vain urged on our Legislature, the necessity of legislating in reference to stationary boilers in our State,) but from some new contrivance, such as the Ericsson engine now in course of construction in New York appears to be.

F.

The Naval Dry Docks of the United States. By Charles B. Stuart, Esq., Engineer in Chief, U. S. Navy. Published by Charles B. Norton, Irving House, New York.

No American work on Engineering has been issued from the press, that will compare with this work in the beauty of its execution, or the intrinsic value of its contents. While the English press has issued book after book, until there is hardly a subject that has not been fully explained, or a public work that has not been illustrated, we have been quietly purchasing their publications, being satisfied that it would not pay to attempt any thing of the kind in this country. This is certainly a melancholy fact, if true. When we reflect that in railroads, water works, gas works, steam ships, sailing ships, dry docks, and bridges, we have works of greater magnitude, built at much less cost, it does appear hard that books fully descriptive of such works, illustrated in a manner commensurate with their importance, cannot be made to pay sufficiently well to justify the expense. This has been the opinion of the past. Mr. Stuart thinks *that time* has gone by, and having been engaged for several years on the stone Dry Dock at New York, the Sectional Docks of Philadelphia and California, and the Balance Docks of Portsmouth and Pensacola, he has concluded to publish a part of his labors, and hence the present work. It is illustrated with twenty-four engravings on steel, made to an accurate scale, so that if measured, each dimension will be found to agree with the description. Every engineer will appreciate the value of such drawings, for, unfortunately, the engravings of many publications in this country and Europe, if judged by this standard, will be found mere pictures. The work also contains the history of each dock, the nature of its foundation, the quantity and kind of material used, the time and cost of its construction, the names of the engineers and contractors, and a great deal of valuable information to those at all interested in the public works of the nation. We trust that Mr. Stuart has not over-estimated the amount of support that his book will receive in this country, and we hope the American people will come forward in a liberal spirit, and sustain a publication so creditable to the country.

B.

INDEX.

LIST OF AMERICAN PATENTS, WITH REMARKS, &c.

JOURNAL

OF

THE FRANKLIN INSTITUTE,

OF THE

State of Pennsylvania,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE, CIVIL ENGINEERING, THE ARTS AND MANUFACTURES, AND THE RECORDING OF AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED BY

JOHN F. FRAZER,

Assisted by the Committee on Publications of the Franklin Institute.

COLLABORATORS.

For Mechanical and Physical Sciences.
ALEX. DALLAS BACHE, LL. D.
JOHN C. CRESSON, A. M.
THOMAS EWBANK.
RICHARD A. TILGHMAN, A. M.
B. H. BARTOL.
J. VAUGHAN MERRICK.
CHARLES E. SMITH.
ALFRED C. JONES.

For Mining and Metallurgy.
SAMUEL S. HALDEMAN.
B. HOWARD RAND, M. D.

For Engineering and Architecture.
SOLOMON W. ROBERTS, Civ. Eng.
WILLIAM H. EMORY, U. S. Top. Eng.
JOHN C. TRAUTWINE, Civ. Eng.
ELLWOOD MORRIS, Civ. Eng.
ROBERT FRAZER.
GEORGE W. SMITH.

For Manufactures and Commerce.
JAMES C. BOOTH, A. M.
FREDERICK FRALEY.
SAMUEL V. MERRICK.
JOHN H. TOWNE.

REPORTERS.

Charles M. Keller, *of American Patents.*
George Harding, *of Patent Law Cases.*

THIRD SERIES.
Vol. XXIV.
WHOLE NO. VOL. LIV.

PHILADELPHIA:
PUBLISHED BY THE FRANKLIN INSTITUTE, AT THEIR HALL.

1852

JOURNAL

OF

HE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JULY, 1852.

CIVIL ENGINEERING.

On Metallic Constructions. By W. FAIRBAIRN, C. E., F. R. S.*

[Paper read at the Mechanics' Institution, Manchester.]

is nearly half a century since I first became acquainted with the ieering profession, and at that time the greater part of our mechanical itions were done by hand. On my first entrance into Manchester, were no self-acting tools; and the whole stock of an engineering ichine establishment might be summed up in a few ill-constructed s, a few drills and boring machines of rude construction. Now are any of the present works with what they were in those days, and will find a revolution of so extraordinary a character as to appear ose unacquainted with the subject, scarcely entitled to credit. The ge thus effected, and the improvements introduced into our con- ive machinery, are of the highest importance; and it gives me plea- to add, that they chiefly belong to Manchester, are of Manchester th, and from Manchester they have had their origin. It may be in- ing to know something of the art of tool-making, and of the dis- ies and progress of machines, which have contributed so largely to ply the manufactures, as well as the construction of other machines oyed in practical mechanics. In Manchester, the art of calico print- was in its infancy forty years ago; the flat press, and one, or at most, colored machines were all that were in use; the number of those ines is now greatly multiplied, and I believe some of them are ca- of printing eight colors at once; and the arts of bleaching, dyeing, finishing, have undergone equal extension and improvement. In anufacture of steam engines there were only three or four establish- that could make them, and those were Boulton and Watt, of Soho; n, Murray, and Wood, of Leeds; and Messrs. Sherratts, of this

* From the London Civil Engineer and Architect's Journal, May, 1852.

town. The engines of that day ranged from 3 up to 50, or at most, 70 horses' power; now they are made as high as 500, or in pairs from 1000 to 1200 horse. An order for a single engine at that time was considered a great work, and frequently took ten or twelve months to execute; now they are made by dozens, and that with a degree of dispatch as to render it no uncommon occurrence to see five or six engines of considerable power leave a single establishment in a month. In machine making, the same powers of production are apparent. In this department we find the same activity, the same certainty of action, and greatly increased production in the manufacture of the smaller machines, than can possibly be attained in the larger and heavier description of work. The self-acting turning, planing, grooving and slotting machines have afforded so much accuracy and facility for construction as enable the mechanical practitioner to turn, bore, and shape, with a degree of certainty almost amounting to mathematical precision. The mechanical operations of the present day could not have been accomplished at any cost thirty years ago, and what was considered impossible at that time, is now performed with a degree of intelligence and exactitude that never fail to accomplish the end in view, and reduce the most obdurate mass to the required consistency, in all those forms so strikingly exemplified in the workshops of engineers and machinists. To the intelligent and observant stranger who visits these establishments, the first thing that strikes his attention is the mechanism of the self-acting tools; the ease with which they cut the hardest iron and steel, and the mathematical accuracy with which all the parts of a machine are brought into shape. When these implements are carefully examined, it ceases to be a wonder that our steam engines and machines are so beautifully and correctly executed. We perceive the most curious and ingenious contrivances adapted to every purpose, and machinery which only required the attendance of a boy to supply the material and to apply the power, which is always at hand. This subject is an art—I would call it a science—which has occupied the attention of the greatest men from the days of Newton and Galileo, down to those of Watt and Smeaton, and it now receives attentive consideration from some of the ablest and most distinguished men of the present time. And of these I may instance Poncelet, Morni, Humboldt, Brewster, Babbage, Dr. Robison (of Armagh), Willis, and many others, to show the interest that is taken by these great men with the advancement of mechanical science. It must appear obvious to those who have studied and watched the unwearied invention and continued advancement which have signalized the exertions of our engineering and mechanical industry, that neither difficulties nor danger, however formidable, can stand against the indomitable spirit, skill, and perseverance of the English engineer; nor will it be denied, that the ingenuity and never-failing resources of our mechanical population are not only the sinews of our manufactures, railways, and steamboats, but the pride and glory of our country. A great deal has been done, but a great deal more may yet be accomplished, if by suitable instruction we carefully store the minds of our foremen and operatives with useful knowledge, and afford them those opportunities essential to its acquisition. We must try to unite theory with practice, and bring the philosopher into close contact with the practical mechanic. We must try to remove prejudices, and to encourage a sounder system of management

in the manufactures, design, and projects of the useful arts. When this is accomplished, we shall no longer witness abortions in construction, but a carefully, well digested system of operations founded on the unerring laws of physical truth.

To the student in architecture, engineering, and building, there is scarcely any acquirement more essential to professional success than a knowledge of the properties of materials which are used in construction. It is more important than either skill in design or correctness of proportion, whatever the character of the structure—be it a house, a ship, a bridge, or a machine. Before we enter upon its construction, and before we can attain a due and correct proportion of the parts, we must, as a preliminary inquiry, make ourselves acquainted with the material of which it is composed. We must study this material's powers of resistance when exposed to the varied strains of tension, torsion, and compression. We must know something of its elasticity and its powers of restoration under the strains and changes to which it may be subjected; and we must then apply that knowledge by distributing it in such form and quality as will best meet the requirements of the case, and without incurring the charge of an unnecessary or wasteful expenditure. All this knowledge appears to me to be indispensable, before we can attain anything like perfection in the art of construction; and no professor of the useful arts, whether he be an architect, engineer, or builder, can ever lay claim to sound principles of construction, unless he is acquainted with the natural properties of the material with which he deals. I shall, therefore, lay before you, in a tabulated form, a short summary of experimental facts, which you will, I think, find of some importance in their bearing upon the particular construction to which I allude.

Resisting Powers of Cast Iron.—From a number of carefully conducted experiments on cast iron, I have selected the following results. They are the highest in the order of their powers of resistance to a transverse strain, and as in each instance the bar is reduced to exactly one inch square, the results may fairly be estimated as a criterion of the resisting powers of the different irons of Great Britain:—

Transverse Strength of Cast Iron Bars, 1 inch square, 4 ft. 6 in. between the Supports

	Name and No. of Iron.		Breaking weight in lbs.	Deflexion in inches.	Power to resist Impact.
Welsh.	Ponkey,	3 C	581	1·747	992
	Beaufort,	3 H	517	1·599	807
	Beaufort,	3 C	448	1 726	747
	Mean,		515	1·6?1	848·6
English.	Low Moor,	2 C	472	1·852	855
	Butterley,	H	502	1·815	899
	Elsecar,	2 C	427	2·224	992
	Old Park,	2 C	485	1·621	718
	Mean,		471	1·778	863·5
Scotch.	Muirkirk,	1 C	418	1.570	656
	Carron,	3 C	443	1·336	593
	Monkland,	2 H	403	1·762	709
	Gartsherrie,	3 H	447	1·557	998
	Mean,		428	1·556	739

The letters C signify cold blast; H, hot blast.

From the above, it will be perceived that the average transverse strength

of eleven specimens of English, Welsh, and Scotch iron is 471 lbs. on 1 inch square bars, 4 ft. 6 in. between the supports. These again, give a mean deflexion of 1·675 inches, and a power to resist impact of 817. Similar irons will resist a tensile strain and a crushing force per square inch as follows:—

Experimental results to determine the ultimate Powers of Resistance to a Tensile and Crushing Strain; Specimens each 1½ inch high.

Description of Iron.		Tensile strength per sq. in. of section.	Crushing strength per sq. in. of section.	Ratio of Tension to Compression.
Low Moor,	No. 2	6·901 tons.	41·219 tons.	1 : 5·973
Clyde,	No. 2	7·949	45·549	1 : 2·729
Blenarvon,	No. 2	7·466	45·717	1 : 6·123
Brymbo,	No. 3	6·923	34·356	1 : 4·963
Mean,		7·309	41·710	1 : 5·707

In the foregoing experiments, the Clyde and Blenarvon indicate the greatest powers of resistance, either as regards a tensile or a crushing strain.

In addition to the irons given above, which are those in common use, Mr. Stirling's mixed or toughened iron exhibits considerably increased powers of resistance to every description of strain when compared with the unmixed irons. Mr. Stirling has patented a process for mixing a certain portion of malleable with cast iron, and when carefully fused in the crucible, the product is equal to resist a tensile strain of nearly 11 tons per square inch, and a compressive one of upwards of 60 tons, the specimens being 1½ inch long and 1 inch square. This mixture, when judiciously managed and duly proportioned, increases the strength about one-third above that of ordinary cast iron. As the strength of wrought iron is not only a subject of great interest at the present moment, but is likely to become more so every year, I shall have to trespass longer upon your attention than may be agreeable. It is, however, imperative that I should do so, as I shall have occasion before the close of my remarks, to refer to facts, and to deduce therefrom conclusions for the elucidation and illustration of my subject. The importance of an inquiry into the art of ship building will be appreciated by you all, and when you bring to mind the dreadful casualties of navigation—the hardships of shipwreck, and the horrors of fire—you will admit the vast importance of selecting the strongest and safest materials for the construction of our ships. It is chiefly for this reason that I have selected this subject, and ventured to impose upon your attention a few dry figures, in order that you might become acquainted, first of all, with the strength and natural properties of the materials of which ships are ordinarily composed, and attach due weight to their judicious application and distribution in the attainment of a powerful, buoyant, and durable structure. I would not have ventured upon this critical and difficult subject without some practical experience, but having taken an active part, as well as a deep interest, in the earliest stages of the application of iron as a material for ship building, and having until the last two years been extensively engaged as a practical builder, I am perhaps the better able to offer a few suggestions on the advantages and superiority of iron in our war, as well as in our mercantile marine. It is well known to the public that the naval department of the

government abandoned, a few years back, (I think improperly so,) the construction of iron vessels as ships of war. The Admiralty, in my opinion, arrived at a very hasty conclusion in condemning the use of iron, after the very limited number of experiments which had been tried upon iron targets and old iron vessels as to the effects of shot. At several of these experiments I was requested to be present, and although the results were certainly unexpected, and perhaps discouraging, yet they did not, in my opinion, justify the abandonment of a material not only the strongest and lightest for such a purpose, but offering infinite security under all ordinary and many extraordinary circumstances. Even in war steamers when in action the chances are in favor of the iron ship, as it is not only secure from fire, but is much stronger, and will sustain more strain when assailed by storms and hurricanes. Steamers can back out of difficulties and dangers, when sailing vessels must remain exposed; they can assail the enemy at a great distance, and take up any position they choose; and with their great guns and long range inflict severe punishment, and do great execution without receiving a single shot. Speed being thus admitted to be an important element in our war marine, the iron ship, from its lightness and buoyancy, has another evident advantage over the wooden one, as an equal amount of power will propel it faster through the water. In the event of a war, the steam marine of this country should have great command of power, to enable the ship to manœuvre at sea with almost the same geometrical precision as a squadron of horse on parade. They should have the power to advance and retreat as circumstances may require, and the new system of tactics which eventually must come into operation, should inspire confidence in the crew as well as the commander, that the iron steamer is not only formidable but safe, as embodying all the elements of offensive and defensive warfare. In our mercantile marine we are progressing with better prospects and greater certainty; but the decision of the Admiralty to limit the construction of iron vessels in the mail and packet service is, according to my views, uncalled for, and, to say the least of it, inconsiderate. I trust the lords commissioners of the Admiralty will see the necessity, the absolute importance, of rescinding that order, and that we shall not only witness the introduction of iron for that service, but more particularly when steam power is employed in all and in every condition of an effective and a safe marine.

(To be continued.)

The Economy of Railways, as a Means of Transit, comprising the Classification of the Traffic, in Relation to the most appropriate Speeds for the Conveyance of Passengers and Merchandise. By Mr. Braithwaite Poole.*

After referring to the influence which cheap and rapid communications had on the prosperity of a nation, the author alluded to the rise of the railway system in this country, expressing the belief that it would have been economical and wise, if the legislature had in the first instance determined the lines on which the system of railways should have been constructed

* *From the London* Atheneum, April, 1852.

throughout the kingdom, so as to have avoided the present ruinous com petition. The passenger traffic now exceeded, annually, four times th entire population of Great Britain, and was conveyed at three times th speed and one-third the fares formerly charged by the old stage or ma coaches, whilst the cost of conveyance of merchandise, minerals, an agricultural produce, had been reduced 50 per cent., as compared wit the rates charged on canals and turnpike roads fifteen years ago. Th ordinary fares for passengers ranged from twopence three farthings to half penny per mile, and for merchandise from one penny to sixpence pe ton per mile. The author then proceeded to consider the economy whic might be introduced into the working of railways, and divided the sub ject into sixteen different heads, each of which referred to some particul point where it was thought a reduction of expenses might be made. Th principal point advanced was, the amalgamating, or working, of all th railways in four great divisions, and insuring unity of management i every department, in the maintenance of the permanent way, and of th rolling stock, as well as in their manufacture—several improvements i the construction of the wagons being suggested. If a general classific tion of trains were arranged throughout the kingdom, separating eac class, and running them at different speeds whenever practicable, it wa thought that it would be conducive to the interest of all parties, as it wa urged to be a manifest injustice towards those who paid the highest far to find third-class passengers arriving at the same time with them. Pun tuality and regularity required to be strictly attended to for the maint nance of a certain definite speed. Numerous instances were adduced show the vast advantages and economy of the railway system, withou which the penny postage could not have been achieved, or the Gre Exhibition rendered available to the multitude; the produce of the lan and sea, in vegetables, fruit, meat, fish, all provisions and fuel, woul have remained as limited in consumption as heretofore; and the poo man's fireside in the rural districts would never have been warmed b coal.—*Proc. Inst. Civ. Eng.*, *April* 20, 1852.

---

*Cost of Locomotive Power on the Caledonian Railway.**

During the last half year, the locomotive power on the Caledonia Railway has cost, for passenger trains, 6·66d. per mile; for goods trains 9·47d.; and for mineral trains, 7·20d.; the average being 7·61d. per mil run, against 8·47d. during the preceding half year. The expense of loco motive power and carriage stock averages 9·78 per mile, against 10·90d at the corresponding period of the preceding year. The number of mile run with passenger trains amounts to 473,691; with goods, 296,232; an with minerals, 251,499; total, 1,021,422 miles. The number of miles ru by pilot engines was 95,352. The average number of engines in workin order during the half year is 107, and under repair 17. The averag number of carriages in passenger trains 7, and of wagons in goods train 24·47. The working stock consists of 73 passenger engines, 51 good engines, 58 first class carriages, 76 second class, 108 third class, 19 com

* *From the London Practical Mechanic's Journal, May, 1852.*

posite, 2 saloons, 6 post offices, 18 luggage vans, 15 carriage trucks, 15 horse boxes, 17 break wagons, 900 ordinary wagons, 52 coke, 20 covered, and 152 cattle wagons, 10 fish vans, 10 sheep wagons, 3200 mineral wagons, and 2 ale wagons.

AMERICAN PATENTS.

List of American Patents which issued from May 4th to June 1st, 1852, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Rock Drills;* William F. Ash, Springfield, Ohio, May 4.

Claim.—"Having thus fully described the construction of my machine, what I claim therein as my invention is, in combination with the cam wheel and guide, the hanging of the lever, by which the drill is raised, on a jointed arm, so as to give it two sets of motions, viz: up and down, to lower and raise the drill, and a backward and forward motion, from and towards the cam wheel, to operate the machine without noise or jar; the whole being arranged substantially in the manner and for the purpose specially set forth and described."

---

2. For an *Improvement in Leather Gauges;* Lewis W. Beecher, Avon, New York, May 4.

Claim.—"What I claim as my invention is, the wheel with its inclined planes or wedges, arranged so as to act upon the roller frame, substantially in the manner herein set forth."

---

3. For an *Improvement in Potato Washers;* Alonzo Bentley, Honesdale, Pennsylvania, May 4.

"The nature of my invention consists in the employment of a revolving screen concentrically within a closed cylinder; the shaft of the former running through tubular projections forming the bearings of the latter; the potatoes being fed within the revolving screen, and water or steam supplied as requisite."

Claim.—"What I claim as my invention is, the screen and cylinder combined, the screen working within the cylinder, and its axis or shaft working within or through the tubular projections or bearings of the same, substantially in the manner and for the purposes set forth."

---

4. For an *Improvement in Lever Jacks;* Levis H. Davis, Assignor to J. A. Dugdale, Kennett's Square, Pennsylvania, May 4.

Claim.—"What I claim as my invention is, the combination of lever, the lip, and the cleat constructed as herein set forth, with the dog and the spring, so as to act together in the manner and for the purposes herein stated."

---

5. For an *Improvement in Electro-Magnetic Alarm Bells;* Moses G. Farmer, Salem, Massachusetts, May 4.

"My invention consists of mechanism of peculiar construction, which is put in operation by electro-magnetism, and so combined with a train of wheel work, cams, spring, weights, and a hammer, to cause successive blows to be struck upon a bell, any required number of times; the main feature of the invention consisting in this, that I am enabled, by its use, to bring into action any desirable amount of force, either of gravity, of a spring, of currents of air, or of steam, and control the duration of the same by the electro-magnet."

Claim.—"I claim as my invention, the combination, substantially as herein set forth, of the electro-magnet and armature, (or its electro-magnetic equivalent,) with the falling ball, or spring, and the detents, and the lifting cam, or its equivalents, so arranged, that

when the ball is supported by the armature, a slight force, only, of the electro-magnet, is required to trip the ball; which ball, in falling, acquires sufficient momentum to produce much greater mechanical effects than the magnet alone; the velocity of the ball, in falling, being still further accelerated by the force of a spring if desired; the power thus obtained, I use in the manner and for the purpose herein described."

---

6. For an *Improvement in Washing Machines;* Christian Hollingsworth, Liberty, Indiana, May 4.

"The feature of novelty of my invention consists in the employment of balls of wood or other substance of sufficient hardness and buoyancy, which, floating in the water, in contact with the linen, the latter being worked up and down, between and among the balls, is subjected to a constantly varying and yielding rubbing pressure."

Claim.—"Having thus described the nature of my invention, what I claim therein as new is, the application, substantially as described, to the process of washing, of balls of wood, or other buoyant material, in connexion with a reciprocating frame, or equivalent device, by means of which a rolling, yielding, or evenly pressing surface is presented to the clothes, or other articles to be washed."

---

7. For an *Improved Adjustable Wrench;* Andrew Hotchkiss, Sharon, Connecticut, May 4.

Claim.—"What I claim as my invention is, constructing the collar or eye of the inner jaw, with an aperture therein of greater section than the bar on which it slides, in combination with the spring therein, and the screw thereto attached; the whole constructed and operating substantially in the manner and for the purpose herein described."

---

8. For an *Improvement in Differential Safety Valves;* John M'Clintic, Philadelphia, Pennsylvania, May 4.

Claim.—"Having thus fully described my improved safety valve, I would state that I do not claim constructing a valve that shall act upon the differential principle, or one which will not admit of the application of external weight or pressure; but what I do claim as new is, the peculiar arrangement and combination of the hollow cylinder box, D, sliding in case A, with the conical valve, and tubular valve rod, and escape pipe, constructed and operating substantially as in the manner and for the purpose herein fully set forth."

---

9. For an *Improvement in Railroad Car Brakes;* Thomas G. McLaughlin, Kensington, Pennsylvania, May 4.

Claim.—"What I claim as my invention is, the employment of the radial bar, turning loosely on the brake lever shaft of the tender or forward car, and spring, for enabling the brakesman to operate the brake of the tender or forward car on which he is stationed, without altering the position of the radial bar after being set, as described."

---

10. For an *Improved Anvil;* Charles Peters, Trenton, New Jersey, and William Fetter, Bucks County, Pennsylvania.

Claim.—"What we claim as our invention is, a cavity in the body of anvils, for the purpose of cooling the same, by the introduction of water or other fluid into the said cavity, while the faces of the said anvils are undergoing the process of tempering."

---

11. For *Improved Machinery for Grinding Conical Edged Knives;* James L. Plimpton, Westfield, Massachusetts, May 4.

Claim.—"Having thus fully described the nature, construction, and operation of my invention, I will now state what I claim as new therein; I claim, 1st, the combination of the curved way and table thereon, provided with appropriate automatic contrivances for traversing the latter along the former, with the carriage on which they are both supported, and which is provided with axis and screws, or their equivalents, to adjust said carriage to any required angle with the horizon, for the purpose herein fully described.

"I claim, 2d, operating the feed motion, or the motion for carrying the edge of the knife across the periphery of the stone, by means of a roller bearing on the periphery of the stone, in the manner and for the purposes herein fully set forth.

"I claim, 3d, connecting the carriage and the table which carry the knife, with the roller receiving motion from the stone, by means of the combination of mechanism, substantially as herein described, by which the motion of the roller towards the axis of the stone, consequent upon the wear of the stone, will cause the knife or knives being ground, to follow the periphery of the stone, and thereby compensate for its wear, and preserve the required form of the edge or edges of the knives, viz: that of an arc of a circle, as herein fully set forth."

---

12. For an *Improvement in Churning Machines;* Gelston Sanford, Ellenville, New York, Assignor to George A. Meacham, Enfield, Connecticut, May 4.

Claim.—"Having thus fully described my invention, what I claim therein as new is, the arrangement of dogs or pawls, J J^1, and pin *h*, with wedges K, L, for the purpose of tripping each other."

---

13. For an *Improvement in Funnels;* Christen Schneider, Washington, District of Columbia, May 4.

Claim.—"What I claim as my invention is, the measuring funnel, constructed substantially as herein set forth, with an interior ventilating tube, to admit air beneath the valve."

---

14. For an *Improvement in Machinery for Grinding or Polishing Saw Blades, etc.;* William Southwell, Kensington, Pennsylvania, May 4.

Claim.—"1st, The combination of two grindstones, or their equivalents, revolving in the direction herein made known, for the purpose of grinding or polishing two sides of a saw or other article, simultaneously, with a reciprocating frame, or its equivalent, for the purpose of holding the article being ground or polished, whereby the tendency of either stone to move the article is counteracted by the action of the other stone, and the same force is thereby required to reciprocate the article in either direction, as described.

"2d, The combination of the right and left hand screws, carriers, and nuts for said screws, movable pedestals or boxes, together with the cross shaft, worms, worm wheels, and handles, substantially set forth, for the purpose of moving two grindstones, or their equivalents, simultaneously against opposite sides of an article being ground or polished as described.

"3d. I do not claim giving an automatic traverse motion to grindstones; but what I do claim is, the arrangement of screws, mitre wheels, handles, eccentrics, eccentric boxes, and movable frame, substantially as herein described, whereby I am enabled, at any time, to move the grindstones, or their equivalents, entirely across the machine, for the purposes set forth, without interfering with the automatic traversing motion which is given to the said stones, irrespective of their precise position with reference to either saw frame or either saw, or other articles fixed in said frame.

"4th, The arrangement in the same machine, of two sets of reciprocating frames, either of which can be stopped without affecting the other, and a carriage, whereby the grindstones can be caused to move from one frame to the other; by which arrangement one saw can be ground or polished, while another is being adjusted into place."

---

15. For an *Improvement in Lightning Rods;* James Spratt, Cincinnati, Ohio, May 4.

Claim.—"Having thus fully described the nature of my improvement, what I claim therein as new is, the formation of the point of a lightning rod, of three or more metals, encased one within another, the most fusible to the outside, in order to prevent the destruction of the entire point, by melting from an overcharge of the electric fluid."

---

16. For an *Improvement in Window-Blind Machinery;* Daniel H. Thompson, Springfield, Massachusetts, May 4.

Claim.—"Having described the nature, construction, and operation of my invention, I will proceed to state what I claim. I claim, 1st, Hanging the auger shaft in swinging

arms or gates of different lengths, hung on centres, said centres being in line, so that by moving the said swinging arms or gates nearer to or further from a position at right angles to the line in which the centres are placed, the distance between the said auger shafts, taken in lines parallel to the line of centres, will be increased or decreased, and thereby be adjusted to different widths of slats lying upon each other, as herein substantially set forth.

"I claim, 2d, The combination of the sliding bar or carriage, carrying the stiles and rods, with the reciprocating carriage, carrying the mortising augers and wire hole pickers, in the manner substantially as described, for the purpose of boring the mortises in the slats, and pricking the wire holes in the rods, and ensuring the distances between the mortises and points of attachment of the slats being precisely the same throughout.

"I claim, 3d, The reciprocating slat table, or bed, made in three parts, X, Y, Y^5, the two end parts of which are adjustable to the middle part, in combination, substantially in the manner described, with the adjustable cutter heads, to wit: the end parts Y, Y^5, of the table or bed, and the cutter heads being adjustable, relatively to each other, for the purpose of tenoning or turning down the pivots on both ends of slats of various lengths.

"I claim, 4th, Pricking the wire holes in the slats, and feeding them at proper intervals from the box in which they are contained, to the bed or table upon which they are tenoned, by means of a vibrating feeder, deriving its motion from the bed or table carrying the slats, the said feeder being provided with suitable horns, or their equivalents, and prickers, for the purpose of entering the box, and pricking and pushing out the slats one after the other, in succession."

---

17. For an *Improvement in Speaking Tubes;* Thos. J. Woolcocks and Wm. Ostrander, City of New York, May 4.

Ceaim.—"What we claim as of our invention is, the combination of an alarm valve with a speaking tube, or pipe, in the manner and for the purpose substantially as herein set forth."

---

18. For a *Blind and Shutter Fastener;* Samuel Barker, City of New York, May 11.

"The nature of my invention consists in securing or fastening shutters, by having the upper portion of the pintle of the hinge of a square or many sided form, and the upper part of the socket (its inner surface) of a corresponding figure, a space being between the upper portions of the socket and pintle; a cap corresponding in form to the upper portions of the socket and pintle, fits over the pintle, and prevents the socket from turning around it, and consequently the shutters from swinging."

Claim.—"What I claim as new is, the method of securing or fastening window shutters, by having the upper portion of the pintle of the hinge of a square or other many sided form, and the upper portion of the socket of a corresponding shape, a space being between the socket and pintle, to receive the cap, which corresponds in shape to the upper portion of the pintle and socket, and fits on the pintle and in the socket, securing or fastening the shutter, as herein specified."

---

19. For an *Improvement in Portable Cot Bedsteads;* William C. Betts, City of New York, May 11.

Claim.—"What I claim as my invention is, 1st, The elevation in the side rails, as a substitute for the pillow, as described.

"2d, I also claim the dovetails, as used, for attaching and detaching the legs to and from the side rails, that is to say, the dovetails entering their mortises from opposite ends of the cot frame, so that they cannot readily loosen by use.

"3d, I also claim the arrangement of the right and left hand screws, which unite the opposite legs at their crossings, in such a manner that the screws shall tend to tighten the joint as the legs separate from each other, or loosen the same as they approximate.

"4th, I claim the combination of the tense bars, having right and left screws, with the side rails of a cot bed, for the purpose of keeping the sacking bottom tense."

---

20. For an *Improvement in Railroad Car Seats;* Abel B. Buell, Westmoreland, New York, May 11.

"The nature of my invention consists in attaching to the backs of the ordinary car seats, outer sliding backs, which may be raised or lowered, as required."

—"What I claim as my invention is, constructing the backs of railroad car seats : sliding backs, fitting in slides, and held by springs, for the purpose of elevation ordinary back, or depression below it, as herein shown and set forth."

---

n *Improvement in Meat Cutters;* William Burns, Rome, Ohio, May 11.

—"I am aware that most of the parts contained in this description of my im-sage machine are not in themselves, separately considered, novel; but that they r, or more or less connectively, in similar machines, been employed or patented, cylinder armed with knives, and rotating within a concave, the frame having a ng and a discharging channel, and the gearing for imparting to the cylinders a tion. I therefore do not claim as new any of these parts separately considered, tive of the manner or arrangement in which I propose, in combination, to apply he purposes and to produce the advantages specified.

hat I do claim as new is, arranging in separate concaves, maintaining vertical and uniting with each other, two cylinders, the one above the other; the upper ting to partially mince the meat, and deliver it upon the lower cylinder, revolving er speed, for reducing it to the required fineness, as described."

---

n *Improvement in Measuring Faucets;* Jacob R. Byler and George W. Senso-Beartown, Pennsylvania, May 11.

ature of my invention consists in so forming a measuring and drawing faucet, shall always be filled with the fluid or liquid to be drawn, and so that it may be drawn out of the faucet at any time and immediately, without awaiting the slug-ment of such articles as above mentioned."

—"What we claim therein as new is, the so constructing of a faucet for mea-d drawing molasses, honey, oil, tar, or other liquids, as that they shall always rged with a measured quantity of the liquid, which may be forced out of the stantaneously, however thick or sluggish it may be, when the same is accom-means substantially the same as herein described and represented."

---

n *Improvement in the Manufacture of Brushes;* Abbot R. Davis, East Cam-e, Massachusetts, May 11.

—"I claim as my invention the above described improvement in filling the holes -block with bristles, the same consisting in the employment of a frame to con-bristles in mass, and hold them in the brush-blocks, and in the direction of their holes in the block, in combination with giving to such block and frame such ts, rappings, jarrings, or blows, as to cause the bristles, by the force of gravity or n, to pass into and fill the holes in the block, as hereinbefore stated."

---

n *Improvement in Cooking Boilers;* L. S. De Bibory, Baltimore, Maryland, 11.

—"What I claim as my invention is, the application of the small cup to the ot, as herein described."

---

n *Improvement in Apparatus for Soldering in a Vacuum;* Joseph B. and R. Horne, Xenia, Ohio, May 11.

—"What we claim therein as new is, the application to the purpose of soldering n, of a hollow bent tube for the reception of a heater, the said tube being closed er end, and provided with a screw-thread at its upper end, fitting tightly within eck or collar upon the glass receiver of an ordinary air pump, or other suitable t for producing a vacuum, the bent form of the tube bringing it to bear, during n, upon the perimeter of the circular disk which closes the aperture."

---

n *Improvement in Blocks for Printing Oil Cloths;* James Jenkins, Elizabeth-, New Jersey, May 11.

ature of my invention consists in attaching to two of the corners of wooden pat-

tern blocks, a gauge, admitting of adjustment to accommodate the expansion and contraction of the wood; also, by means of horizontal pitch points, (formed of a screw working in a collar on the gauge,) adjusting the parallelism of the edge of the block and face of the stock, enables the printer more accurately and expeditiously match the block, or as it is technically termed, register."

Claim.—"Having described the nature and operation of my invention, I do not claim the construction of the stock or gauges thereon; but what I do claim as new is, the movable gauge, in combination with the adjustable point, or its equivalent, to compensate for the contraction and expansion of the pattern block, in the manner and for the purpose substantially shown and described."

---

27. For an *Improvement in Platform Scales;* Robert Newell, Lebanon, Indiana, May 11.

Claim.—"What I claim as new in the above described scale or balance is, the rod, r, and the rod and socket, *w*, and sector, *z*, or their equivalents, in combination with the revolving head and face, (or graduated plate,) and hand or index, to show at once, and in any required direction, the weight of the article weighed."

---

28. For an *Improvement in Lead Pipe Machinery;* Benjamin Tatham, City of New York, May 11.

"My said invention is an improvement upon the method of making pipes from set or solid lead, described in the specification of a patent granted to Thomas Burr, of Shrewsbury, in Shropshire, England, dated the 11th day of April, A. D. 1820."

Claim.—"I am aware that the invention of this machinery describes the core as being forced to the centre of the die, and retained there by the pressure of the issuing pipe; and therefore I do not claim, broadly, having the core so that it shall not be affected by the vibrations of the ram.

"What I do claim as my invention is, connecting the core with the ram, by means of an universal joint, or its equivalent, substantially as specified, so that the core shall be retracted with the ram, in combination with the cylinder and die of a machine for making pipe by pressure, from lead or other soft metal, run into the cylinder and on to the said core in the molten state, substantially as specified, whereby the core is retracted with the ram, and held in position while the charge is poured in, and during the operation of forming the pipe, the vibrations of the ram do not practically affect the central position of the core in the dies, as herein specified."

---

29. For an *Improvement in Tables;* Timothy H. Taylor, Fayetteville, New York, May 11.

Claim.—"I claim, 1st, The employment of flies, *g g*, levers, *h h*, or their equivalents, in combination with the spiral springs, *e*, or their equivalents; the whole being constructed and arranged and operating in the manner and for the purposes substantially as herein set forth.

"2d, The employment in the manner substantially as herein described, of the levers, *h h*, or their equivalents, in combination with the flies, *g g*, for the purpose of lowering the table leaves when desired."

---

30. For an *Improvement in Gold Beating Machinery;* William Vine, Hartford, Connecticut, May 11.

"The nature of my invention consists in the combination of a cam, or its equivalent, so constructed as to be of a double form and action, with a rod sliding through a cylinder which is provided with a pivot, so that it is free to move horizontally; said rod giving the appropriate movement to the packet, and the object of the invention being to give to said packet motions in two directions with only one cam."

Claim.—"What I claim as my invention and improvement is, the double action adjustable, differential cams, or their equivalent, combined with the sliding rod and pivoted cylinder, in connexion with other parts of gold beating machinery, substantially in the manner and for the purpose as herein set forth and described."

---

31. For an *Improvement in Mash Tuns;* Robert Wicks and James Faulkner, Jr., Williamsburg, New York, May 11.

"The nature of our invention for cooling the contents of the mash tun, consists in sp-

plying the top, bottom, and sides of the tun with sufficient water, until the enclosed mash is reduced to the proper temperature."

Claim.—"What we claim as our invention is, the completely enveloping the mash tun with water, or sufficiently so to produce the desired rapidity in cooling the mash."

32. For an *Improved Implement for Cutting Butter from Firkins;* Nathaniel Woodbury, Salem, Massachusetts, May 11.

Claim.—"What I claim as new is, the knife operated by means of the levers, or their equivalents, in combination with the piston, and the box, the knife, levers, and piston being constructed, arranged, and operated in the manner and for the purpose substantially as herein shown and described."

33. For an *Improvement in Carding, by which Variegated Slivers are Produced;* Jonas Holmes and Ephraim French, Lee, Massachusetts, May 18.

Claim.—"What we claim as our invention and improvement is, traversing the doffer or doffers of a card, or setting the teeth upon them, serpentine or zig-zag, or serpentine and zigzag, or in such other curves, points, or angles, as may suit the taste or fancy of the operator; also to traverse them when so set, if desirable, so as to take the wool or other materials, from such parts of the main or other cylinder of the card, and deliver it to the condensing rollers or other apparatus, so as to make roving variegated, either in colors, or materials, or both, when said colors or materials are fed upon the card, substantially as described."

34. For an *Improvement in Stoves;* George W. Kennison, Newburyport, Massachusetts, May 18.

"In a stove constructed on my improved plan, a most perfect control of the draft and consumption of the coal is attained, with a distribution of radiated heat, that renders the stove very pleasant and agreeable in its effects on the air (of the apartments) that impinges against the external surface of the drum."

Claim.—"It is therefore that my invention, and what I claim, consists in a combination of the following particulars, or elements, viz: 1st, A close drum or chamber, made with one or more air inlets, and their closing slides or doors in the lower part, and a fuel opening and door, at or near its upper part.

"2d, A fire pot or chamber of combustion, placed within the said drum, and having a grate in its lower part, and a smoke discharge pipe leading out of it, at or near its upper part.

"3d, An air space under the fire pot grate.

"4th, A space between the external sides of the fire pot and the internal sides of the drum, and made to freely communicate with the space under the grate.

"5th, A space above the fire pot, or place for the fuel, and made to freely communicate with the space around the fire pot.

"6th, A fuel supply opening and door, and an air register in the top of the fire pot; the whole being arranged and made to operate together substantially as above described."

35. For an *Improved Ships' Block;* Charles H. Platt, City of New York, May 18.

"The nature of my invention consists in encompassing the cheeks of the block with metal hoops or bands, which fit in grooves in the peripheries of the cheeks; said hoops or bands being bent at the upper end or part of the block, so as to form eyes, through which a bolt passes which secures the cheeks the proper distance apart at the upper end."

Claim.—"I do not claim the metal plate for connecting the cheeks, for that has been previously employed; but what I claim as new is, the employment or use of the metal bands or hoops; said hoops or bands encompassing the cheeks, and fitting in grooves in the peripheries of the cheeks, the hoops or bands having eyes formed in them at the upper end of the block through which the bolt passes, securing the cheeks the proper distance apart at the upper end of the block, as set forth."

36. For an *Improvement in Umbrellas;* J. V. Tibbets, City of New York, May 18.

"The nature of my invention consists in having a certain number of steel rods brought

to a spring temper, and attached at their tops, either by springs or joints, to a slide; said slide being placed upon a vertical rod; this forms the frame."

Claim.—"Having thus described my invention, and the manner of using the same, I wish to state that I do not lay special claim to the device consisting of a female screw slide, working over or on a screw rod, and operating together, for opening and closing the frame of the umbrella, as the devices to effect this may be varied; but what I do claim as my improvement is, distending or opening the umbrella, by the rods which have heretofore simply served as stays to the covering, and been permanently attached thereto; the covering being secured to the apex of the central rod, and the lower ends of the distending rods; and this I claim, whether the inner ends of the distending rods be made to descend, or the central rod to ascend with the apex of the covering, in distending the umbrella.

"I also claim the manner of securing the cover to the frame, viz: by means of swivels attached to the cover, and screwed into the ends of the rods, as herein described.

"I also claim the application of the springs of the rods F, to the slide E, operating in the manner and for the purpose described."

---

37. For *Improvements in Iron Safes;* William Alford and John D. Spear, District of Southwark, Pennsylvania, May 18.

Claim.—"What we claim as our discovery, invention, and improvement is, the application of chalk, or whiting, which has been subjected to the action of acids, and has been partially deprived of the carbonic acid, the material which we use being in fact the waste or residual matter, left from the manufacture of what is called mineral water, after chalk or whiting has been subjected to the action of acids, for the purpose of expelling a portion of its carbonic acid; this residual matter consisting substantially of the substances named in the analysis before referred to, in the construction of double iron chests, or safes, in the manner above described, or in any other manner substantially the same."

---

38. For an *Improvement in Saw Sets;* Asahel G. Bachelder, Lowell, Massachusetts, May 18.

Claim.—"What I claim as my invention is, the dog or set, J, so constructed and arranged, as to traverse or slide upon a rod or bar, in a direction parallel to the toothed edge of the saw, for the purpose of setting the same, substantially as described."

---

39. For an *Improvement in Straining Saws in Saw Mills;* Edm. Booth, Philadelphia, May 18.

"The nature of my invention consists in the employment of a lever, passing through and working freely in, and up and down an oblong slot, cut in a vertical post secured to the top, and nearly in the centre of the saw mill. This lever is attached at one end, near its fulcrum, to a rod or link, which connects it to a spring secured to the top of the saw mill, and the other end is inserted into the upper guide rod of the saw, and works in a slot in the same."

Claim.—"What I claim as new is, the employment of the lever, or its equivalent, the spring connected to the lever by a rod or link, which is secured or attached to the lever, near its fulcrum, both operating together and in combination with a reciprocating saw, connected to the lever, and the whole being constructed and arranged and operating substantially as herein described."

---

40. For an *Improvement in Cartridges for Breech Loading Guns;* Wm. W. Marston, and Frederick Goodell, City of New York, May 18.

Claim.—"We do not claim to have invented any of the separate parts described herein; but we do claim as new and of our own invention, the application of the leather breech piece to cartridges used with breech loading guns, such leather breech piece serving the purposes of a foundation for its own cartridge, a protection to the breech pin, a wad for the next cartridge in succession, and of a swab to clean out the soilage caused in the barrel by the antecedent explosion, producing a safe cartridge for pieces that load at the back of the breech, and in which explosion is also caused in the line of the axis of the barrel, substantially as described and shown, but without regard to the sizes of arms

d with these cartridges, and irrespective of the machinery, or mechanical means, by ich the cartridge itself is made."

For an *Improvement in Swings;* Edward Maynard, City of New York, May 18.

Claim.—"Having thus fully described my invention, what I claim is, the combination the wire frames, constructed as set forth, with the net work and swing cords."

For an *Improvement in Cotton Batting;* E. P. Rider, Brooklyn, New York, May 18.

Claim.—"Having thus described my invention, what I claim as new is, uniting two more layers of cotton batting together, by means of any glazing material, thereby pro-ing a new article of manufacture, which I term cotton felt, to be used for upholstery l all other purposes to which it is applicable, as herein set forth."

For an *Improvement in Churns;* Clarkson Rhodes, Morrow, Ohio, May 18.

"The nature of my invention consists in the manner I work the beaters or dashers, by ouble belt cranked shaft, together with the method I employ, to suspend said beaters or hers on their fulcrums."

Claim.—"What I claim as my improvement is, hanging the series of beaters or dashers rods, extending from the shaft, the lower end of which rods supports the fulcrum, on ich the beaters or dashers move, (not confining myself to the number or form of the hers,) the said dashers being operated by the rods and bell cranks, substantially as ein forth."

For an *Improvement in Ovens;* Thomas N. Reid, Baltimore, Maryland, May 18.

"My invention consists in furnishing an oven, with all the characteristics of a baker's n, with the addition of such fixtures as are necessary for cooking, heating water and for household purposes; the utility of an oven of brick, such as used by professional ers, heated conveniently, need not here be enumerated, while the advantages of com-ing therewith, cooking apparatus for domestic use, are incalculable."

Claim.—"Having thus fully described my improved oven, with cooking apparatus at-hed, what I claim therein as my invention is, the construction of said oven, with re-ses on the side or sides for fuel, substantially as set forth above, and in combination rewith, the cooking chambers as herein described."

For an *Improvement in Hay Rakes;* Charles R. Soule, Fairfield, Vermont, May 18.

Claim.—"What I claim as my invention is, so constructing revolving spring tooth es, as to bring the centre of revolution nearer the lower ends of the teeth, than can done by having them revolve on the head around which the teeth are coiled, (which is usual mode,) by which means I cause them to revolve much quicker, and in going a ch shorter distance than otherwise can be done; while at the same time they revolve ch easier and more readily, in consequence of having the second head, coil, &c., to ance, or nearly so, the remaining heft of the teeth, &c., which will be on the other e of the centre of revolution, or nearly so; thereby giving the required length and elas-ty to the teeth, with a quick and easy revolution, which I accomplish as herein set th, or by means analogous thereto."

. For an *Improvement in Cements;* B. S. Welch, Brooklyn, New York, May 18.

Claim.—"Having thus described my invention, I claim the primary cement herein de-ribed, formed of the hydrate of lime, in a finely subdivided state, and resin in a finely bdivided state, mixed together with water in a cold state, for the purpose set forth."

7. For an *Improvement in Machines for Making Fuses;* Albert F. Andrews, Avon, Connecticut, May 25.

Claim.—"What I claim as my invention is, passing the hollow mandrel through the ding spools, in combination with the flyers, which direct the winding thread from the

different spools to the interior of said mandrel, for the purpose of winding the fuse as it passes from the forming machine, when combined substantially as herein described."

48. For an *Improvement in Locomotive Boilers;* James W. Farrel, Reading, Pennsylvania, May 18.

Claim.—"What I claim as my invention is, isolating the lower portion of the water space surrounding the furnace from the upper portion, and connecting it by a free and constantly open communication with the tank of feed water, in such manner that the feed water of the tank will circulate without being forced by a pump in contact with the fire plates, to cool them, and to be itself heated, preparatory to being pumped into the boiler, substantially as herein set forth."

49. For *Improvements in the Tumblers of Locks;* Henry Blakely, City of New York, May 25.

"My invention consists in an improved construction of tumbler locks, and in the manner of operating them; in the finer sort, those intended for affording the greatest possible security, very skilful workmanship is required to obtain that extreme accuracy in the construction of the various parts which is essential to their successful operation."

Claim.—"What I claim as of my own invention is, firstly, the employment of tumblers in such combination with the bolt of the lock, that each and every tumbler, independent of the others, shall have freedom to move laterally, as well as vertically, whereby a great number of positions may be assumed by their unattached ends as described.

"Secondly, I claim the guide pieces upon the key, for the purpose of controlling the lateral motion of the tumblers as described; the whole being constructed and operating, substantially in the manner and for the purpose herein set forth and described."

50. For an *Improvement in Watch Chain Swivels;* W. B. Carpenter, Assignor to W. D. Salisbury and S. Y. D. Arrowsmith, City of New York, May 25.

Claim.—"What I claim as my invention is, making the joint of the opening piece *i*, oblique to the eye, so that it will open obliquely to the hook piece *a*, or *b*, in the manner and for the purpose herein set forth."

51. For an *Improvement in Mortising Machines;* John B. Chambers, Pittsburg, Pennsylvania, May 25.

Claim.—"Having fully described my several improvements, and sufficiently so for the better illustration of the former, the parts (not new) connected therewith, and constituting in combination the machine, I desire it to be understood that the main principle of action involving reciprocating chisels, and by a ratchet wheel feeding on the timber, is not by any means new; nor do I claim such, these being well known and common to other mortising machines; nor yet do I claim reversing the chisel; neither do I claim, separately of themselves, the device by which I effect my improvements: but what I do claim as my invention is, 1st, the employment of a stop catch, or hook, operated on by the reach arm, or pawl, to prevent the momentum given to the ratchet wheel from throwing the pawl out from between the teeth, after having performed its pull, and so making irregular the feed, one of the ratchet wheel teeth being beveled or reduced, in order to admit of the pawl entering sufficiently deep to arrest the motion of the feed, in the manner and for the purpose set forth.

"2d, The combination and arrangement of the stud, clutch arm, lever, cam, and stop, so that when the lever is thrown in, the cam will unclutch the machine, when the chisel crank is on the full centre, and the chisels are out of the work, and retain them in that position by the clutch coming in contact with the stop; the several parts being made, arranged, and operated in the manner herein fully set forth."

52. For an *Improvement in Stone Dressing Machines;* Simon W. and Reuben M. Draper, Boxborough, Massachusetts, May 25.

Claim.—"What we claim as our invention is, hanging the arm carrying the pick upon

a shaft, which receives a vibratory motion through a cam, driven by a mill spindle, or other spindle provided for the purpose, and giving the said arm a motion lengthwise along the said shaft, substantially as and for the purpose herein described."

---

53. For an *Improvement in Swivel Hooks;* Albert and Morris Falkenau and Moris Pollak, City of New York, May 25.

Claim.—"We do not claim to have invented any one of the parts described and shown, as these in themselves, separately, are not new; but we do claim the combination of the spring, and its inclosing slide, with a swivel hook, for the purposes and as described and shown."

---

54. For an *Improvement in Worm Tubs for Stills;* George Johnston, Farmington, Iowa, May 25.

Claim.—"What I claim as my invention is, the division of the worm tub into an upper and a lower compartment, and connecting them to each other by a valve, so arranged that it will be operated by the influence of the temperature of the water in the upper compartment, for the purpose of enabling the distiller to keep the water in the said upper compartment at any elevated temperature that may be required for use, in preparing the distiller's beer, or fermented wash, or for other purposes in the distillery."

---

55. For an *Improvement in Flour Bolts;* David Marsh, Fairfield, Connecticut, May 25.

Claim.—"I do not claim to be the first to use a flat sieve or bolter, to separate substances of different sizes; what I do claim as new and of my own invention is, the construction, arrangement, and combination of the shafts and cranks 3 and 6, to receive and move the bolter *c*, with the cranks 7 and 8, and connecting bar *a*, or their equivalents, as described, to regulate and equalize the movement, the coarser particles being carried off from the bolter *c*, by the flexible tube *f*, or other convenient means; the whole being substantially as described and shown.

"And I claim the application of the breakers or spreaders *d*, in the bolting box *c*, to prevent the material working off too fast, and spread it evenly over the sieve or bolter *e*, as described and shown."

---

56. For an *Improvement in Lubricating Oils;* William H. Mason, Boston, Massachusetts, May 25.

Claim.—"Having described the character of my invention, I will state that I am aware that spirits of turpentine and carbonate of potash have been used before my invention, in lubricating compounds, and I do not, therefore, claim them, except as specific agents to accomplish a definite and specific purpose stated in the specification; what I claim as my invention is, the combination of a mixture of camphene and benzole, carbonate of potash and glycerine, with whale or other cheap oil having similar properties, in the manner and for the purposes set forth."

---

57. For an *Improvement in Hominy Machines;* Samuel Hull, Carroll County, Maryland, May 25.

Claim.—"What I claim by my invention is, the combination of the beaters *c*, *c*, with the beaters D D, each set moving in opposite directions, as set forth in the foregoing specification, substantially and for the purposes therein noticed."

---

58. For an *Improvement in Railroad Car Trucks and Brakes;* E. G. Otis, Bergen, New Jersey, May 25.

Claim.—"I do not claim the winding of the chain around the axle, for the purpose of pressing the shoes against the wheels; neither do I claim the clutch, nor the collar, separately, for they have each been previously used; but what I do claim is, 1st, the method of operating the toggle joint, by means of the rod, having the cam upon it, which works in a slot in the bar, by which the clutch is thrown in and out of gear, or the cap made to

2*

bear against the hub of the wheel, in combination with the compensating joints constructed in the manner and for the purpose as shown and described.

"2d, I claim the employment of the guards, vertical studs, and rods, arranged as described, for the purpose of enclosing the wheels and prevent them getting off the track, in case of the breakage of a wheel or axle, in combination with the arms and bolts, by which the trucks are suspended to the car bed, in the manner and for the purpose as herein specified."

---

59. For an *Improvement in Cooking Apparatus;* Joseph Smolinski, City of New York, May 25.

"The points in which I claim to have made improvements are, the enveloping the centre of the stove or furnace, (as, for instance, the oven, or place for cooking,) with the smoke flues, carrying them up and down upon each side, and above and beneath, so that all the caloric in the smoke may be absorbed, before it passes out at the chimney; and, secondly, the combining with the stove, an easy and efficient mode of ventilation."

Claim.—"What I claim as my invention is, 1st, The peculiar arrangement of the smoke flues, as shown in figures 13 and 14, by which they are made to envelope the centre on all sides, and thus concentrate them in the smallest possible space.

"2d, The combination with this machine, of the key and valves, for ventilation and supply of air to the furnace from the room as above described."

---

60. For an *Improvement in Cast Iron Car Wheels;* Stephen Thurston, Scranton, Pennsylvania, May 25.

"This invention consists in connecting the hub and rim, by a single plate of a peculiar form, which I consider well adapted to stand the shrinkage, in cooling, and to withstand the jarring to which all wheels are subject in running, and which presents no difficulties in moulding."

Claim.—What I claim as my invention is, constructing the hub and rim of a solid cast iron railroad wheel, by a single plate, having two series of radial corrugations, substantially as herein described."

---

61. For an *Improvement in Machines for Jointing Staves;* Dennison Woodcock, Independence Centre, New York, May 25.

Claim.—"What I claim as my invention is, jointing the staves by means of cutters set at an inclined position, and converging towards one another in the front, the said cutters having a motion given them perpendicular to the stave, for formation of the bilge, or varying width of the stave, by means of the cam, the framing, and their accompanying parts, or devices equivalent thereto, operating substantially as specified."

Re-issue for May, 1852.

1. For an *Improvement in Apparatus for Parti-Coloring Yarn;* Alexander Smith, West Farms, New York; dated June 18, 1850; re-issued May 11, 1852.

Claim.—"What I claim as my invention is, the method substantially as specified, of parti-coloring yarns that have been reeled by direct and free immersion by means of frames carrying the reeled yarns, and combined with the vat containing the dying liquor, by means of machinery adapted to let down and draw up the said frame, and measure the extent of immersion, substantially as set forth.

"I also claim, connecting one or both of the reels in each frame by means of slides, to admit of removing the reel from contact with the yarns, whilst in the process of dying, substantially as specified."

Designs for May, 1852.

1. For a *Design for a Cooking Stove;* Apollos Richmond, Assignor to A. C. Barstow & Co., Providence, Rhode Island, May 11.

Claim.—"What I claim as my production is, the new design, consisting of the ornamental sheaf work, vine and flower work, &c., herein above described and represented in the drawings, for the front, side, and back plates of a cooking stove."

For a *Design for a Cooking Stove;* Hosea H. Huntley, Assignor to David D. Woodrow, Cincinnati, Ohio, May 11.

Claim.—"What I claim as my invention is, the design and configuration of the ornaental stove, all in combination, as herein substantially specified and represented in the companying drawings."

For a *Design for Cook Stoves;* Thomas A. Herrick, Boston, Assignor to Lemuel M. Leonard, Taunton, Massachusetts, May 18.

Claim.—"What I claim as my production is, the new design, consisting of the ornantal mouldings, ribs, and rays, herein above described and represented in the drawings, the side plate of a cooking stove."

For a *Design for a Cook Stove;* Nicholas S. Vedder and William L. Sanderson, Troy, Assignors to Peter J. Clute, Schenectady, New York, May 18.

Claim.—"What we claim as new is, the ornamental design and configuration of cook ve, the same as herein described and represented in the annexed drawing."

For a *Design for Ladies' Hair Combs;* William Redheffer, District of Spring Garden, Pennsylvania, May 25.

Claim.—"What I claim as my invention is, the design and configuration of fancy mbs, above described."

For a *Design for a Towel Stand;* Nathaniel Waterman, Boston, Massachusetts, May 25.

Claim.—"I claim the ornamental design or configuration, substantially as represented the drawings."

JUNE, 1852.

For an *Improvement in Fountain Pens Holder;* Charles Cleveland, Middlebury, Vermont, June 1.

By this improvement the inconvenience and interruption of dipping the pen in ink is ided; and the pen, with a supply of ink in the fountain, can be kept in the pocket, ly for use, occupying no more space than the ordinary pen and holder."

laim.—"What I claim as my invention is, the combination of the valves in a foun pen, for the admission of air, and regulating the flow of ink, with the slide or buttons, with the spring and slide, in the manner above described, or in any other substantially same."

For an *Improvement in Corn Shellers;* David Eldridge, Philadelphia, Pennsylvania, June 1.

Claim.—"What I claim as new and my improvement is, the combination of the conical cave wedge and the guard with the concave wheel, for shelling corn, as herein deibed."

For an *Improvement in Railroad Car Wheels;* Nehemiah Hodge, North Adams, Massachusetts, June 1.

Claim.—"What I claim as new is, the construction of car wheels, the combination of segmental ring and keys, constructed substantially as described, or their equivalents, the purpose of facilitating the insertion of the ring or band of india rubber, or other tic material, between the central portion and the rim of the wheel, and as a means of ening or holding the whole together, as herein set forth and shown."

4. For *Improvements in Copying Manuscript;* John Jones, Clyde, New York, June 1.

Claim.—"What I claim as new is, 1st, The employment or use of the circular rack which serves as a guide to the index, said rack having a rim attached to its under surface and projecting outwards, with the necessary letters and characters stamped or placed upon it, corresponding to the type placed on the periphery of the horizontal wheel, as specified.

"2d, I claim placing or securing the type vertically to the periphery of a horizontal wheel, having a rotating motion, and also a motion in the direction of its axis, by which with the aid of the rack and index, the required letters may be printed upon the paper, in combination with the roller, the levers, and the shaft, or other equivalent device, for the purpose of operating upon the cylinder and adjusting it, to allow for the different thickness of type on the wheel, as herein described.

"3d, I claim the employment of the cylinder upon which the paper is secured, said cylinder having a motion in the direction of its axis, and also a rotating motion, said motion being communicated to it by the devices as shown and described, or in any other equivalent manner."

---

5. For *Improvements in Violins;* William S. Mount, Stony Brook, New York, June 1.

Claim.—"That which I claim as my improvement is, the construction of that portion of stringed musical instruments which receives the strain of the strings, when tightened in tuning, in such form or forms as will cause the line of that portion of the instrument to be lengthened instead of shortened, if the same be altered at all by the strain.

"I also claim the hollow backed violin, or other stringed musical instrument of similar character, constructed substantially in the manner herein set forth."

---

6. For an *Improvement in Revolving Breech Fire Arms;* Henry S. North, Middletown, and Chauncey D. Skinner, Haddam, Connecticut, June 1.

Claim.—"What we claim as our invention is, the construction of the sliding crotch, substantially as described, to enable it to perform the double purpose of revolving the breech and wedging it up against the barrel; and the combination of the sliding crotch and guard lever, constructed and arranged as specified, by which the breech is rotated, wedged forward, and the gun cocked by one motion back and forward of the trigger guard, or its equivalent, substantially as above described."

---

7. For an *Improvement in Smut Machines;* G. S. Peck, East Smithfield, Pennsylvania, June 1.

Claim.—"What I claim as my invention is, the arrangement in which the grain is fed in at or near the bottom of the cylinder, through which it is elevated, by means of spirally inclined beaters, and discharged through the passage or spout, in combination with the ascending blast from the fan or blower, the same being arranged and operated essentially as above set forth and described."

---

8. For *Improvements in Power Looms;* Rensselaer Reynolds, Valatia Village, New York, June 1.

Claim.—"What I claim as my invention is, 1st, Connecting the rocker of each picker staff, made and operated substantially as specified, with the bed on which it rocks, by means of an interposed strap of leather, or other flexible substance, attached at the inner end to the bed, and at the outer end to the rocker, substantially as and for the purpose specified.

"2d, Forcing the shuttle binders inwards against the shuttle while boxing, by a gradually increasing force, by means of arms on a rocker, provided with a spring, which is acted upon by a pin on the connecting rod of the lay, substantially as described.

"3d, Securing the raw hide pickers to the inner face of the staffs, by means of a leather strap, or the equivalent thereof, embracing and binding the two together, substantially as described, to insure the firm union to resist the rapid blows, and to prevent pieces of raw hide from breaking and flying, as set forth."

1. For an *Improvement in Cast Iron Car Wheels;* Daniel R. Rall, Rochester, New York, June 1.

Claim.—"I do not claim the concave plates or sides of the wheel; nor do I intend to mit myself to the precise form of such plates connecting the hub with the rim or tread f the wheel. But I claim the partitions or braces connecting the rim or tread with the ro plates or sides of the wheel, the said partitions or braces extending from the inside of e rim or tread radially, or nearly so, part of the distance towards, but not connecting ith the hub, as herein fully set forth."

. For an *Improvement in Fire Escape Ladders;* John C. fr. Salomon, Georgetown, District of Columbia, June 1.

Claim.—"What I claim as new is, forming or constructing a ladder with each succes- e step, from the end or ends, longer than the one preceding it, and connecting said eps with each other by links made fast at one end to each step, and the other end sliding rough eyes in the step above or below, so that the steps can all fold closely together, in e manner substantially as described."

---

1. For *Improvements in Looms for Weaving Piled Fabrics without the Figuring Wires;* Robert W. Sievier, Cavendish Square, England, June 1, 1852; patented in England, September 5, 1844.

"My invention consists, 1st, in a peculiar mode of producing and raising the terry or oops of such fabrics as Brussels carpeting, coach lace, velvets, or other similar fabrics, nd which are woven by me, without the aid of intervening wires or tags, as commonly mployed, to form such terry or loops, or raised surfaces; and, 2d, in certain improvements n looms, in order to render the same more capable of effecting that object."

Claim.—"Having now described the particular feature of my improvements in looms r weaving, and the mode or method of producing plain or figured goods or fabrics, I esire it to be understood that I claim as my invention, 1st, The novel mode or method f producing plain or figured goods or fabrics, having terry or looped surfaces of the kinds bove described, by partially beating up certain picks of the shoot or weft threads, and fterwards further beating up or driving home those picks or shoots, in order to cause cer- ain portions of the terry warp to pucker up in loops; but I do not confine myself to any articular number of picks or shoots of weft, but have described a method by which my nprovements in producing plain or figured goods or fabrics, having a terry or looped gure, may be accomplished, as the number of picks or shoots of weft may be varied, to roduce a different appearance in the face of the fabrics woven under my patent, according the desire of the weaver.

"2d, I claim varying the forward stroke of the batten, to produce the open or close beat- ig up of the weft, substantially as described, in combination with the apparatus for hold- ig the surface threads or yarns, and carrying them forward in the manner described, or ny other substantially similar, for the purpose of aiding in forming, in the loom, the loops f terry fabrics."

---

2. For an *Improvement in Vertical Trip Hammers;* Peter Stebbins and John Holmes, Schenectady, New York, June 1.

Claim.—"We are aware that vertical trip hammers, elevated by friction rollers, are not ew; neither are cams for regulating the elevation to which such hammers shall be lifted; nd therefore we do not claim them: but what we do claim as our invention is, 1st, The ecessed rollers in combination with the plain rollers and springs, or their equivalents, for ontrolling the operation of the lifting rollers; the projections on the said recessed rollers ausing the shaft, lifting roller, and plain rollers to recede or move from the rollers on the haft, and thereby allow of the hammer to fall; the whole being constructed, and arranged, nd operating substantially as herein described.

"2d, The manner herein described of regulating the blow of the hammer, by making the ecesses in the periphery of the rollers of unequal lengths, and making the said rollers novable on their shaft, so that either projection can be brought opposite to and made to ct in combination with the plain rollers in the manner herein set forth."

contended that the tonguing and grooving apparatus in these machine was identical with that of Woodworth, and that the planing wheels employed by these defendants were so placed as to describe a more clearl perceptible cone than in Patton's machine. On behalf of these defendant it was admitted that the tonguing and grooving tools were similar to those of Woodworth; but it was insisted that the planing wheel did not describ a conical surface, and that pressure was neither required nor used whil the board was being planed.

Two bills had been filed against Snowden, the defendant in the thi suit,—one was filed by J. P. Wilson, as assignee of the Woodworth pa tent, and the other by J. P. Wilson, as assignee of the Barnum planin machine patent. It was complained that Snowden infringed on the Ba num patent, by using the precise machine described and patented l Barnum for planing; and that he infringed on the Woodworth patent l using the same tools and combination in tonguing and grooving as we described therein. The latter infringement was not denied by the d fendant during the argument, but it was contended that the defenda had acquired a right to use the Barnum machine, by virtue of a licen from Barnum, the former owner of the patent, and subsequently it w contended that he had acquired this right by the purchase of a machi from Barnum. The complainant denied that any valid title was acquir by Snowden in either manner as alleged.

During the course of the evidence, affidavits stating that the complai ants had been unable to obtain access to examine the respective defen ants' machines were read, and application was made to the Court for order of inspection. Whereupon the following order was made:—

"That the respective defendants do permit an inspection and thorou examination by Harvey Waters, on behalf of the complainants in t above cases, of the planing, tonguing, and grooving machines in cont versy, in each case respectively, and that the said expert be permitted bring any specimens of the work done by the said machines; and t the said machines shall be worked by the servants of the respective d fendants as the said Harvey Waters may request."

Mr. Waters afterwards was examined in Court as an expert, and e hibited specimens of the boards planed at the several machines. In course of the trial, a very ingenious working model of a planing mach was introduced into Court by the last named expert. Its essential feat was a Woodworth planing cylinder, so constructed and arranged t while the operation of planing was going on, this cylinder could be alte to a cone or to a disk, and vice versa.

The four cases were argued at the same time. Mr. Campbell, l Keller, and Mr. Harding appeared for all the complainants, and l Cuyler appeared for all the defendants. Mr. Hubbell also appeared Patton, and Mr. Taylor for Winslow.

The Court having taken time to consider, delivered the followi opinion on the 28th of May last, granting injunctions in all the cases prayed for.

Opinion.

The effort to smooth boards and reduce them to a uniform thickn *by the rotary* action of cutter knives set in the face of a disk, and und

to revolve in the plane of the intended surface, is of ancient date. But from the time of Bramah, half a century ago, until now, it has never been successful.

If it were practicable to construct a machine, mathematically accurate in all its parts, and of inflexible material, so as to prevent all possible vibration; and if, besides, the wood to be operated on could be first deprived of all its elasticity, then each cutter as it passed on its way, removing a certain portion of the board, would leave the surface absolutely finished behind it—and the other cutters and the same cutter returning in its revolution, all following in absolutely the same plane with the first, would pass over the finished surface, neither abraiding it nor compressing it, yet in contact with it.

But these conditions involve mechanical impossibilities. The strongest engine that ever came from the shops, vibrates sensibly when it encounters an intermitting resistance, and there is no such thing as a non-elastic. The practical consequence is, that the cutters after finishing their work, still continuing to revolve over the smoothed surface, will sometimes be impelled for the instant below the plane of their normal action; and on the other hand, the board partially compressed when under the action of each cutter in succession, but rising again immediately afterwards by its own elastic force, will present a new surface to be acted on by the next cutter—that surface varying in height according to the varying density and consequent elasticity of the board. This is illustrated by the *back-lash*, an irregular trace made on the finished surface by the cutters that continue to pass over it.

Woodworth was the first to propose a remedy for this, by placing his cutters on the periphery of a rotating cylinder, while he presented the face of the board in the tangent plane of their revolution. He thus prevented the cutters, while the board was moving, from tracing it a second time, and gave the *dip and lift cut* which has been so often recognised as the characteristic of his patented machine.

It is obvious that to make this cut, it is not necessary to place the cutters on a true cylinder. A cone, or even a dished wheel, scarcely deviating in appearance from a true disk, will produce the same effect, provided the board approaches and leaves the cutters in the tangent plane of their revolution. I had no difficulty, therefore, when the cases of Plympton and Mercer and others were before me, some years ago, in holding that a cone or dished wheel so arranged, was simply a mechanical equivalent for the cylinder of Woodworth; and the rulings then made, have, on more than one occasion since, received the sanction of both the judges of this Court.

Strange to say, in three of the cases now before me, the principal dispute has been as to the fact, whether the machine used by the defendants is or is not a *disk*, or, as it has been spoken of in the argument, a Bramah wheel. Numerous witnesses, some of them highly respectable, have testified that it is nothing else—and that its cutters move of course in the same plane, and parallel with the lower face of the board—in other words, that the cutting disk coincides in its revolutions with the finished surface. But it is as certain as any truth in the philosophy of mechanics, that in this they are mistaken—for the machine in its ordinary working

leaves no back-lash, and the boards that were passed through it by the gentlemen who inspected it under the Court's order, show une cal marks of the dip and lift cut.

Neither witness nor counsel has explained how a disk which : scribe to be like Bramah's wheel, and worked as his was, can p: results so different from his; nor how it happens that the results pr by it are so precisely those which would be produced by cutters ı ing on a flattened cone. On the contrary, all admit that the machi vibrate, and that the boards which it commonly works on are d not wet, and of course easily compressed under the cutters. It is t more than a reasoning faith in human testimony, to assure us that machine acting on such a material, will in the hands of the defe renounce the mechanical law which it has been exemplifying every else for the last fifty years.

It is true, that upon *tramming* the disk with the bed plate, in o test their parallelism, the defendant's witnesses observed no de from the disk form. But though this were so, yet in just such a d cutters might be arranged in such a manner as to describe a cone revolving; and Mr. Patton's cutters were not, and probably could trammed. Besides which, the axis of the disk was so adjusted at its extremity, as to give it at pleasure the oblique action which is ada the revolving cone, and yet to restore it again in a few minutes, w disk parallel to the bed plates.

When we consider that the machine while at rest can have its c ter thus easily modified, so as to give proof for the time of the para of its parts, if such proof be desirable, and that while in motion, it all scrutiny, revolving, it may be, some 3000 times in a minute, : three cutters therefore following each other with an interval betwee of but the 150th part of a second; and that an obliquity in the di exceeding the $\frac{1}{16}$-th of an inch on its cutting diameter, would be cient to change its effective action; we can apprehend without di that the defendant's witness may have fallen, very honestly, into But it is enough for us to know, that according to the laws of matt motion, which are the condensed expression of all mechanical expe the machine, as they describe it, cannot produce the effects, whi see that the machine produces in fact. The foot print on the san cates with less certainty the form and pressure of the foot that m than a curved cut on the face of a flat board proves a corresp curvature in the path of the cutting tool.

It is in vain to refer us for an explanation to the abnormal infl of vibratory or semi-elastic forces, without showing us what those ences are, and how they resolve—they resolve for the time a disk cone, or enable the machinist to trace a regulated curvilinear surf the rectilinear movement of a plane. This is only to reassert the p in more general language, to prove the controverted fact by refere an unknown theory.

I must hold, therefore, that the planing machine of Messrs. I Ashton & Winslow, and Ashton & Beer, are essentially the same w *planing* apparatus of the Woodworth patent.

The machine employed by Mr. Patton, and, as it is said, invent

him, for cutting the tongue and groove, is spoken of as an elliptical saw. It consists of a revolving saw plate of lozenge shape, set at such an oblique angle as to make all the teeth on its periphery equidistant from its action of motion. In revolving, it describes, of course, a cylinder, and its action is that of a rasp. It does not divide the board as a saw does; but performs the office of Woodworth's duck-bill cutter, somewhat less perfectly, and apparently at greater cost. The only points of difference are that what would be the one cutter of Woodworth is, in Mr. Patton's machine, effectively divided into several, so as to form a series of cutting disks or saws, the teeth of which abrade in succession the portions of the board to be removed, leaving the edges rough in consequence, instead of giving them the comparatively smooth surface of the Woodworth machine; and that while a broken cutter can be removed from the Woodworth disk, and a new one substituted, a tooth broken from Mr. Patton's saw destroys it. Whatever, therefore, may be the supposed interest or novelty of the elliptical saw, it must in its adaptation to this particular use, be regarded as embodying the principle, and constituting, but for its inferiority, the mechanical equivalent of Woodworth's cutting wheel.

The tonguing and grooving apparatus of the Ashton and Winslow, and Ashton and Beer machines, are confessedly those of Woodworth's patent.

The same is true of Snowden's; and his planing machine is an equally direct piracy of the Barnum patent, now held by the complainant.

I have not, in this opinion, discussed the question of the validity or the extent of Woodworth's patent. These have been so often before almost all the Courts of the United States, as to make them inappropriate topics for interlocutory argument. There must be at some time or other an end of controversy as to the character of a patentee's property in his invention; and now that twenty-three years have gone by since the Woodworth patent was issued and passed into litigation, I am disposed to recognise its parting claim to repose; *solve senescentem.* I therefore limited the discussion at its outset to the single question of infringement.

I have one more remark to make, it is prompted by a review of the devices employed by these defendants and those who have gone before them in similar controversies. I cannot but think that the time has come, when, in this District at least, the attempt to mask an infringement of this particular patent should be almost regarded as a waste of ingenuity. It is a truth of large acceptation, both in policy and morals, that it is better in the long run to strive patiently for a legal property of one's own, than to persist in trespassing on the property of others. The invention which is set forth in letters patent *belongs* to the inventor—as rightfully as the house he has built or the coat he wears. It cannot detract from the dignity of his title, that the subject of it is of his own creation, his thought conceived and developed and matured in the recesses of his mind, that it has cost no man else any thing, and asks nothing in return for the contribution it makes to the general wealth and happiness, but that security of enjoyment, during a limited period, which the laws engage for all other property without limitation of time, and without stipulating a price. It would be a reproach to the judicial system, if an ownership of this sort could be violated profitably or with impunity.

The complainant's counsel will prepare the draft of decretal orders in he several *cases in accordance* with this opinion.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Inconsistency and Error of the Conclusion arrived at by a Committee of the Academy of Sciences of France, agreeably to which, Tornados are caused by Heat; while, according to Peltier's Report to the same body, certain Insurers had been obliged to pay for a Tornado as an Electrical Storm. With Abstracts from Peltier's Report. By Dr. Hare.

In the 2d series of queries proposed to Mr. Espy, published in the May number of this *Journal*, allusion is made to the report signed by Arago, Pouillet, and Babinet, three distinguished members of the Academy of Sciences of France, sanctioning the idea that tornados are due to the heat of condensing vapor, when agreeably to a report made under the auspices of Arago, the President of that Academy, less than two years before, certain insurers had been obliged to pay for a tornado as an electrical storm.

It is remarkable that Arago, one of the most distinguished electricians in Europe, when requested to decide this question, did not conceive himself warranted in saying whether or not a tornado was an electrical storm. Had the damage been done by lightning, there would have been no doubt as to the nature of the cause; but as it was done by the meteor above mentioned, (called trombe in French,) Arago felt it necessary to send Peltier to examine the phenomena, in order to find out whether or not they were due to electricity. It had often been observed that electrical phenomena were attendant on such storms, and by some observers they had been ascribed to electricity; yet so vague and unsatisfactory had been the evidence or arguments in favor of this view of the question, that they seem to have made no impression on the minds of the sagacious, learned, and ingenious members of the "Academie des Sciences."*

Such, at all events, is the only inference which can be reasonably drawn, judging from the opinions expressed by those among them, who were selected as eminently competent to decide.

It is manifest that Arago had formed no opinion, or he would not have sent Peltier to investigate the phenomena, in order to determine the question. As this philosopher, Pouillet, and Babinet, were chosen as a committee to decide on Espy's theory of tornados, it is to be presumed that they were considered as among those members who were pre-eminently qualified to judge, respecting meteorological theories. Let us then see

*Among those who alleged them to be due to electricity, Beccaria is, perhaps, the most distinguished; but how little he understood the true nature of the meteor, is manifest from his crediting the allegation that they could be dissipated by the presentation of a sword from the deck of a vessel. Evidently no vessel could come within the electrified column without being dismantled, if not wrecked; and if situated outside of the electrified column, how could the electricity reach the sword? But should it be induced to leave its wonted *vertical* path, in order to pass off by this weapon, how could the person presenting the *sword survive* an influence capable of rending the wood of trees into laths, as alleged by *Peltier?*

whether any of the other academicians were, more than Arago, impressed with the idea that electricity was the main cause of tornados.

I subjoin the opinions of Pouillet first.

"*How can this power, sometimes so prodigious, be created in the midst of the sky?* This is a question to which, it must be admitted, science as yet cannot give a precise answer. Of all the vague and hazardous conjectures which have been made respecting the origin of this meteor, probably the least unreasonable is, *that it is a whirlwind of excessive intensity.* But the discussion of this point seems premature. It is necessary to multiply observations, and to compare with more precision all the attendant circumstances of the phenomena." *Pouillet Elemens de Physique Experimental et de Meteorologie.*

To allege a tornado to be a whirlwind, without showing how a whirlwind may be produced or sustained in the case in point, is only substituting one mystery for another. Whirling or gyration is an *effect*, not a *self*-moving power, as some meteorologists seem to suppose.

All the elucidation given by Depretz, another luminary belonging to the same illustrious Academy, is contained in the following language, which is a literal translation from his Traite Elementaire de Physique, page 329:

"*The tornado* ("*trombe*") *is seen upon the sea and upon the land. Sometimes it seems to come out from the bosom of the sea, ascending to the clouds; sometimes it descends from the clouds down to the earth.*"

"*It is a conical column of water, which revolves upon its axis, with great rapidity. The base is sometimes more than two hundred metres in diameter.*"

"*An idea may be had of tornados from the little whirlwinds of dust which suddenly form themselves in summer, revolving with great rapidity.*" Risum teneatis amici!*

That Babinet entertained no feasible idea of the part performed by electricity in the generation of the tornado, is evident; since, after a long discussion, in which no allusion is made to electricity as essential, he terminates with a conclusion favorable to the Espyan hypothesis, and in which electricity is referred to only as a subordinate participant playing a part, respecting which he shows himself incapable of throwing any light. I subjoin his "*conclusion,*" as he designates his ultimate brief exposition of those inferences which his study of the question led him to make.

I use the singular pronoun, his, because Arago assured me he had

* "Comment cette puissance quelque fois si prodigieuse peut-elle prendre naissance au milieu des airs? C'est une question, il faut le dire, à laquelle la science ne peut faire aucune réponse précise. De toutes les conjectures vagues et hazardées que l'on peut faire sur l'origine de ce météore la moins invraisemblable est peut être celle qui le regarde comme un tourbillon d'une excessive intensité. Mais une discussion sur ce point nous semblait prematurée, il faut multiplier les observations et constater avec plus de precision toutes les circonstances de ces phénoménes." Elémens de Physique et de Météorologie, Tom. 2, page 727.

Tous les détails que Despretz donne sur les trombes se trouvent dans ces paragraphes que j'emprunte à son traité de Physique.

"*Trombe.* La trombe se montre en mer et sur la terre; tantôt elle semble sortir du sein de la mer et s'élève jusqu'aux nuages; tantô elle descend des nuages jusqu'à terre.

Cest une colonne d'eau conique qui tourne sur elle même avec une grande vitesse; elle a quelque fois jusqu'à plus de deux cents mêtres de base. Elle est très-commune entre les Tropiques. Les navigateurs passent rarement près des côtes de Guinée sans en apercevoir plusieurs.

Les trombes produisent des effets terribles, elles déracinent les arbres renversent les faibles habitations soulèvent les voitures etc.

Ou peut se faire une idée des trombes par des tourbillons de poussière qui se forment tout-a-coup en été sur les routes et qui tournent sur eux mêmes avec une grande rapidité Traité Elem. de Physique, parag. No. 656, pag. 328.

nothing to do with the report, and Pouillet let it pass, because Arago could not attend, and he could not agree with Babinet; while Espy was very urgent to have the report before leaving Paris.

Babinet's "Conclusion."

"In conclusion, Mr. Espy's communication contains a great number of well observed and well described facts. His theory, in the present state of science, alone accounts for the phenomena, and, when completed, as Mr. Espy intends, by the study of the action of electricity when it intervenes, will leave nothing to be desired. In a word, for physical geography, agriculture, navigation, and meteorology, it gives us new explanations, indications useful for ulterior researches, and redresses many accredited errors.

"The committee expresses then the wish, that Mr. Espy should be placed by the government of the United States in a position to continue his important investigations, and to complete his theory, already so remarkable, by means of all the observations and all experiments which the deductions even of his theory may suggest to him, in a vast country, where enlightened men are not wanting to science, and which is besides, as it were, the home of these fearful meteors.

"The work of Mr. Espy causes us to feel the necessity of undertaking a retrospective examination of the numerous documents already collected in Europe, to arrange them, and draw from them deductions which they can furnish, and more especially at the present period, when the diluvial rains, which have ravaged the south-east of France, have directed attention to all the possible causes of similar phenomena. Consequently, the committee proposes to the Academy to give its approbation to the labors of Mr. Espy, and to solicit him to continue his researches, and especially to try to ascertain the influence which electricity exerts in these great phenomena, of which a complete theory will be one of the most precious acquisitions of modern science."

Mr. Espy is to study the action of electricity "*when it intervenes.*" Of course, it was only a visiter, according to Babinet's opinions.

Such was the state of knowledge respecting tornados in 1836, when I handed to Arago and other members, copies of my pamphlet, in which I attributed those awful meteors to a convective discharge of electricity in these words: "*After maturely considering all the facts, I am led to suggest that a tornado is the effect of an electrified current of air superseding the more usual means of discharge between the earth and clouds in those sparks or flashes which we call lightning.* While the air is thus carried up by the concurrent influence of electrical attraction and the reaction of its own previously constrained elasticity, other bodies are lifted both by electrical attraction and the blast of air to which it gives rise. Hence houses within the sphere of excitement are burst by the expansion of the air which they contain, their walls being thrown outwards and their roofs carried away, while by the afflux of the atmosphere requisite to the restoration of its equilibrium, trees, houses, and other bodies are thrown inwards towards the vertical current from before as well as from either side."

This rationale of the tornado had been in the hands of the academicians and the library of the Academy for about three years, when, agreeably to an article published at Paris, on July 17th, 1839, in the *Journal des Debats*, a tremendous tornado occurred about the last of the preceding month, at Chatenay, in the vicinity of that metropolis. The losers applied for indemnity to certain insurers, who objected to pay on the plea that the policies were against thunder storms, not againt tornados. This led to an application to the celebrated Arago, who referred the case to another savant, Peltier, as above stated.

From the following narrative, translated from his report, it will be seen

at Peltier adopted my opinion, that a tornado is the effect of an elec-ical discharge.

"Early in the morning a thunder cloud arose to the south of Chatenay, and moved at out ten o'clock over the valley between the hills of Chatenay and those of Ecouen. he cloud having extended itself over the valley, appeared stationary, and about to pass ray to the west. Some thunder was heard, but nothing remarkable was noticed, when out midday, a second thunder storm, coming also from the south, and moving with pidity, advanced towards the same plain of Chatenay. Having arrived at the extremity the plain above Fontenay, opposite to the first mentioned thunder cloud, which occu-ed a higher part of the atmosphere, it stopped at a little distance.

* * * * *

"Up to this time there had been thunder continually rumbling within the second thunder oud, when suddenly an under portion of this cloud descending and entering into com-unication with the earth, the thunder ceased. A prodigious attractive power was exerted rthwith, all the dust and other light bodies which covered the surface of the earth ounted towards the apex of the cone formed by the cloud. A rumbling thunder was ntinually heard. Small clouds wheeled about the inverted cone, rising and descending ith rapidity. An intelligent spectator, M. Dutour, who was admirably placed for obser-ation, saw the column formed by the tornado terminated at its lower extremity by a cap ' fire; while this was not seen by a shepherd, Oliver, who was on the very spot, but en-loped in a cloud of dust.

"To the south-east of the tornado, on the side exposed to it, the trees were shattered, hile those on the other side of it, preserved their sap and verdure. The portion attacked ppeared to have experienced a radical change, while the rest were not affected.

* * * * *

"Finally, it advanced to the park of the castle of Chatenay, overthrowing every thing in s path. On entering this park, which is at the summit of a hill, it desolated one of the ost agreeable residences in the neighborhood of Paris. All the finest trees were uprooted, e youngest only, which were without the tornado, having escaped. The walls were rown down, the roofs and chimneys of the castle and farm house carried away, and anches, tiles, and other movable bodies, were thrown to a distance of more than five undred yards. Descending the hill towards the north, the tornado stopped over a pond, illed the fish, overthrew the trees, withering their leaves, and then proceeded slowly along avenue of willows, the roots of which entered the water, and being during this part of s progress much diminished in size and force, it proceeded slowly over a plain, and finally, the distance of more than a thousand yards from Chatenay, divided into two parts, one f which disappeared in the clouds, the other in the ground."

"In this hasty account I have, with the intention of returning to this portion of the sub-ect, omitted to speak particularly of its effect upon trees. All those which came within e influence of the tornado, presented the same aspect; their sap was vaporized, and their gneous fibres had become as dry as if kept for forty-eight hours in a furnace heated to inety degrees above the boiling point. Evidently there was a great mass of vapor in-tantaneously formed, which could only make its escape by bursting the tree in every irection; and as wood has less cohesion in a longitudinal than in a transverse direc-on, these trees were all, throughout one portion of their trunk, cloven into laths. lany trees attest, by their condition, that they served as conductors to continual discharges f electricity, and that the high temperature produced by this passage of the electric fluid, stantly vaporized all the moisture which they contained, and that this instantaneous va-orization burst all the trees open in the direction of their length, until the wood, dried up nd split, had become unable to resist the force of the wind which accompanied the tornado. n contemplating the rise and progress of this phenomenon, we see the conversion of an rdinary thunder gust into a tornado; we behold two masses of clouds opposed to each ther, of which the upper one, in consequence of the repulsion of the similar electricities rith which both are charged, repelling the lower towards the ground, the clouds of the atter descending and communicating with the earth by clouds of dust and by the trees. This communication once formed, the thunder immediately ceases, and the discharges of lectricity take place by means of the clouds, which have thus descended, and the trees. These trees, traversed by the electricity, have their temperature, in consequence, raised to uch a point that their sap is vaporized, and their fibres sundered by its effort to escape. Flashes, and fiery balls, and sparks accompanying the tornado, a smell of sulphur remains or several days in the houses, in which the curtains are found discolored. Every thing roves that the tornado *is nothing else than* a conductor formed of the clouds, which serves

as a passage for a continual discharge of electricity from those above, and that the difference between an ordinary thunder storm and one accompanied by a tornado, consists in the presence of a conductor of clouds, which seem to maintain the combat between the upper portion of the tornado and the ground beneath."

Less than two years after the allegations and inferences comprised in the preceding abstracts were reported to the Academy, and after the insurers had been obliged, as *Peltier informed me*, to pay for it as an electrical storm, Babinet sanctioned the idea that the main cause of tornados is the heat imparted to an ascending column of air by condensing vapor, electricity occasionally intervening, but not being in the least essential to the generation or endurance of the meteor.

There is another narrative published in the *Comptes Rendus*, or Journal of the Proceedings of the Academy, which confirms that of Peltier in every essential particular. Both of these narratives agree with that which I had given respecting the tornado of New Brunswick, excepting that the chemical effects upon the trees appear to have been more violent at Chatenay.

Although Peltier made his report (of which abstracts have been given) three years after I personally handed my pamphlet to Arago and other members, leaving one in the library of the Academy, he alluded to my memoir only in order to show that he owed nothing to it. In the point of the greatest and most evident importance I had manifestly anticipated him. I allude to the inference, that during a tornado an electrical discharge takes place by means of the column or trunk, superseding the lightning by which, during ordinary thunder storms, discharge is effected. There is, *so far*, a perfect identity between his inferences and mine. These, with the facts established by the survey at New Brunswick, and by his own statements, shew that there can be no rational explanation of a tornado, but that of its being the result of a convective discharge. I am not in the least disposed to contest any honor which he may have acquired from so much of his explanations as are inconsistent with that given by me.

That the idea of Peltier that the cloud acts as a conductor is untenable, must be evident, since the light matter of which a cloud is constituted could not be stationary between the earth and sky in opposition to that upward aerial current of which the violence is admitted by him to be sufficient to elevate not only water, but other bodies specifically much heavier than this liquid.

Moreover, I have ascertained that dense fog produced within a glass vessel, does not act as a conductor so as to discharge an electrified knob of iron. When subjected to the exciting power of an electrical machine, the knob gave sparks as well when the fog was present, as when it was away. The knob was made red hot, to prevent the interference of condensing moisture.

But independently of this experimental evidence, were moisture in the state usually designated as fog or cloud a conductor, how could it issue from an uninsulated high pressure boiler highly charged with electricity? As soon as, by the escape from confinement, the pressure is relaxed, one *portion* of the steam is resolved into low pressure or rare steam, while *another* portion precipitating, assumes the state of the aqueous matter in a cloud.

The upward current of air, and the carrying up of movable bodies, which has been fully established to be characteristic of tornados, and of which Peltier himself confirms the existence, is irreconcilable with conduction, but is just what a carrying discharge would involve as a matter of course.

Subsequently to the publication of my memoir on the cause of tornados, in the *American Philosophical Transactions*, and *Silliman's Journal*, for the year 1837, Faraday distinguished that species of electrical discharge which takes place by a current of air, or by the movement of bodies situated between the electrified surfaces, and consequent alternate contact therewith, as the "*convective* discharge;" while the discharge by means of sparks or lightning were designated by him as *diruptive.*

The employment of these terms renders the demonstration of my rationale more easy to state. These modes of discharge have been witnessed by every person who has ever been present when the most common routine of electrical experiments has been exhibited, in which not only the spark is shown, but the dancing of pith-balls, or of puppets, the ringing of bells, the rotation of wheels, or the blasts produced by electrified points, causing such wheels to rotate.

It is notorious that either of these modes of discharge may be made to take place, by varying the distance, or the form or character of the masses employed.

Thus, in the experiment in which pith-balls are made to resemble hail, by dancing between oppositely electrified disks, an approximation of one of the disks towards the other induces a spark or diruptive discharge, and thus causes dancing to cease. In Cuthbertson's balance electrometer the movable ball approaches that which is stationary, in obedience to the convective process; but as soon as the distance between the balls is reduced within the striking distance, a diruptive discharge ensues, indicated as usual by a spark.

It follows that by a slight variation as to distance, the same degree of electrical excitement may be productive either of a convective, or of a diruptive discharge. Excepting a prodigious disparity in magnitude, the diruptive spark discharge is universally recognised as perfectly similar to lightning. Both the one and the other process are admitted to be due to discharges of electrical accumulations, differing only as to magnitude. Since, agreeably to this exposition, susceptibility of commutation exists, as respects diruptive discharge in its minuter forms, and convective discharge upon the same scale, does it not follow that the former, as produced by the gigantic processes of nature, should be commutable with a convective process of corresponding immensity? But if the spark be exemplified by lightning, how is the convective discharge to be exemplified? Where is there any gigantic meteorological process which can supply the deficiency, excepting that of the tornado or hurricane, which last may be viewed as a tornado on a scale of pre-eminent grandeur?*

* Experience shows that the denser portion of the atmosphere, which lies between the storm clouds and the earth, is competent to act as an electric; since otherwise there would be no thunder gusts, nor any atmospheric discharges as displayed in the form of lightning. That air, rarefied to a certain degree, becomes capable of acting as a coating does in the instance of the Leyden jar, is proved by the fact that the inner surface of a glass globe, within which the air is rarefied by exhaustion, may be charged like a Leyden jar, if to the

If from a point electrified by a machine, a blast of air may proceed as strong as from a blow-pipe supplied by a bellows, may not an enormous blast be emitted from every terrestrial prominence, electrified by the powerful apparatus of nature, as much greater than that of a blow-pipe, as a spark of lightning of a mile in length, exceeds that yielded by an excited conductor or charged jar? So long as there is an ascent of air consequent to electrical convection, there must be a confluence of the same fluid from two or more opposite quarters, to supply the deficit thus created; and the air as it follows the electrified column being successively similarly electrified, that enduring trunk or column is formed and sustained which characterizes tornados or water-spouts.

Within this traveling trunk, which, in its form, contortions, and deleterious power, resembles that of an enormous elephant, as mischievous as gigantic, bodies are not only subjected to the same convective influence as the air, but are also exposed to the upward force arising from a vertical blast. On each side of the track which marks the progress of the trunk, bodies are subjected to the confluent blasts, which rush in to supply the upward current.

The alternation of the convective and diruptive discharges was well exemplified in the phenomena of the Providence tornado of 1838, as described by a most worthy and well informed observer, Zachariah Allen, Esq. As soon as the trunk reached the river, the water throughout the included area, rose up as in a state of ebullition by the convective influence; but a diruptive discharge, in the form of lightning, taking place, the foam subsided momentarily, yet rose again, until by another spark of lightning another subsidence ensued. Were ever facts more accordant with an explanation than those observed by Mr. Allen, with the hypothesis which I advanced?

Against the idea that there could be any adequacy in the apparatus of nature, such as to make bodies dance between the earth and sky, as pup-

outer surface a conducting body be applied, and a due communication made with an electrical machine in operation.

As it is well known that the terrestrial surface is a conductor, it follows that in that surface, the denser air in proximity therewith, and the rarefied conducting air above, we have an electric between two conductors competent to act as coatings. Thus the dense air acts as a glass pane between two coatings, or as the glass in an exhausted globe acts between the rarefied air within and the hand of the operator without. We have, therefore, all that is requisite to the reception of an electrical charge.

That the means of disturbing of the electric equilibrium are abundantly prolific, the terrific discharges of lightning in electrical storms can leave no doubt.

Using the language of the Franklinian theory, I urged that, in the concentric spaces occupied by the earth and that occupied by the rare conducting medium above alluded to, there must be two oceans of electricity, which could not fail from mechanical or chemical causes to be in different states. But assuming that electricity is a result of the polarization of the ethereal fluid, to the undulation of which light is ascribed, we are led to substitute for oceans of a specific fluid, the idea of a boundless ocean of ethereal matter, which by peculiar affections may become competent to perform, within the concentric spaces alluded to, the part assigned by Franklin to one fluid, by Dufay to two fluids.

Consistently it may be inferred that an atmospheric charge may extend all around the globe, so as to make one great battery analogous to that above described of the exhausted glass globe; the rarefaction being in one case internal, in the other external. Agreeably to these considerations, there are no limits to the possible extent of atmospheric accumulations of electricity, while the rapidity with which discharges pervade conductors is such as to render distance no obstacle.

d pith-balls are seen to dance between electrified brass disks, it
:n urged by Prof. Espy, that a stratum of an elastic fluid like air,
ıot perform the part of a solid metallic disk.

answer to this is, that whatever state of things is competent to electrical charges, is competent to produce any of the phenomena ıarges. Just as much stability is requisite to enable the diruptive ge of lightning to take place, as to enable the convective discharge ornado or water-spout.

onclude, I claim to have laid before the scientific world a memoir, :h the tornado is made to bear the same relative position to light- at the carrying discharge does to the electrical spark, and to have e first electrician that ever pointed out this simple and true relation n those awful meteors. I urge that the language, proceedings, and of the French academicians show, that they were entirely unpre- or this new view of the subject. Hence, nearly five years after- notwithstanding the tornado at Chatenay and Peltier's Report, and ıad sent them meanwhile a pamphlet containing a translation of my r into their own language, they still remained in utter darkness: t meanwhile, Peltier, with the approbation of Arago, the President Academy, had adopted essentially my explanation; attempting, er, to put my theory in the back-ground, by substituting *conduction vection.*

have elsewhere said, Franklin by aid of a kite-string demonstrated ntity of lightning with the electrical spark or diruptive discharge. to have shown, by reasoning and a reference to experimental ce, that the tornado is identical with the convective discharge of :ity.

the State of Atmospheric Strata holding Accumulations of Electricity Thunder Storms.—In order to sustain the inferences which I have :ed, it is sufficient, as already avowed, to point out that no diffi- :an be ascribed to the existence of an electrical accumulation com- to produce a convective discharge in the form of a tornado, which ot apply equally against any accumulation of the same nature, ca- of producing diruptive discharges, as in the case of lightning. ecise mode in which a thunder cloud becomes a reservoir of elec- and afterwards emits it as lightning, was not suggested by Franklin, still undecided. That this precision of explanation has not been d in the case of the tornado, cannot then be fairly or consistently d as an objection to our considering this meteor as the offspring of the ›arent.

e strive to electrify a ball suspended to a steelyard or scale beam, uthbertson's electrometer, so as to be equiponderant with a counter- : on the other arm of the beam, it will descend as soon as charging ences. Wherefore, then, do not thunder clouds descend in obedi- › an incipient charge? I believe this question has never been an- l.

›uld suggest that, agreeably to Faraday's researches, we are justi- supposing that as the charge consists more or less of the polari- of the aerial particles, by which they assume a certain arrangement

indispensable to an electrical charge, and which grows with its
and strengthens with its strength.

Thus there may be a simultaneous and commensurate affect
which the opposite polarities, usually called the opposite elect
created at the surfaces of the electrified (or, as I would say, po
stratum of the atmosphere, are produced together with that arrar
of the aerial atoms in rows, like iron filings situated between pc
magnet. Hence the same electrifying causes which induce in
treme surfaces a reciprocal attraction, cause in the intermediate
proportional indisposition to undergo the derangement which any
ence to that attraction would involve.*

Objections to Espy's Hypothesis.—It is well known that, when su
rarefied, air is refrigerated; hence, when a receiver is first subje
exhaustion, a cloud appears within it, arising from the condensa
aqueous vapor. Dalton found that when the air thus rarefied was
of aqueous vapor, it became much colder than when this vapor was

* If when there is a great accumulation of electricity, sufficient for the emissio
ning, we suppose the atmospheric stratum which holds the charge to perform tl
the glass in a charged pane, the cloud and the earth acting as coatings, the
rationale may be countenanced by the facts.

This rationale assumes that electricity consists of opposite polarities, resulting,
day supposes, from an "*action*" of atoms in proximity, or as I infer, from a polar
resulting from the polarization of etherial matter associated or combined with p
matter. The same reasoning would apply were the hypothesis of two fluids as
which the phenomena are ascribed no less to repulsion than to attraction.

Let us suppose a stratum of the atmosphere to be situated just above the heigh
miles, and of course to have only half the mean density of a stratum resting on t
trial surface. Let it be supposed that these strata are oppositely electrified, as in
of thunder storms. Of course, the oppositely excited strata will have a tenden
proach each other, while the terrestrial surface, similarly electrified with the lowe
will repel this, simultaneously attracting the upper stratum. But will the att
the earth for the sparse and remote air of the upper stratum balance the repulsion
by it towards the contiguous and denser stratum below? Will not the force in
instance be greater, first, because, in the same space, there are twice as many
repel, and in the next place, because they are in proximity to the earth? See S
Journal, Vol. v., n. s., p. 345.

Again, while the similarly electrified aerial particles in either stratum must r
other in consequence of their similar excitement, will not this effect in the lowe
be twice as great, (if not quadruple,) in consequence of there being twice as ma
in the same space? Thus while gravitation is counteracted by electrical repu
gaseous elasticity of the air is increased by the same cause. Hence arises an
and ascensional power. Although the whole of the atmospheric stratum simila
fied by the terrestrial surface must be repelled thereby, yet the force being equa
buted, is insufficient to cause the whole to be elevated so as to create a vacuu
under these circumstances that either the diruptive discharge may take place in
of lightning, in which case an intermediate row of aerial particles become instru
the meeting of two opposite waves of electro-polarity; or a convective discharge
place by a concentration of the forces on a comparatively minute columnar space.
this space all the forces are exaggerated which have been assigned to the a
Hence, while the aerial elasticity is assisted by a reciprocal electro-polar repu
whole mass of the air and bodies within the space are violently repelled by t
Hence the expansive power by which houses are burst, and bodies, sufficiently
movable, are borne aloft accompanied by an electrified aerial blast.

An exemplification of this concentration of force is to be seen in the perforati
glass of a charged jar.

Were the mean height of the upper stratum only $1\frac{1}{2}$ miles, the difference of
would be only one-fourth of that assumed, but still evidently there would be a
more than sufficient to account for the expansive and ascensional power.

ıis he ascribed to the latent heat given out by aqueous vapor on con-
:nsing. Before I had the pleasure of knowing Mr. Espy, I contrived
ı apparatus for showing the cold and cloud produced by rarefaction.
'lliman's Journal, Vol. 13, *p.* 4.

This apparatus, as well as that employed by Dalton, does not differ
sentially from Espy's nephelescope, which is the name given by him to
ı instrument answering the same purpose as that employed by Dalton.
otoriously, the density of the air diminishes, in a geometrical ratio, as
ıe place of examination is higher; so that at the altitude of three miles
is only half as dense as upon the earth's surface.

Davy, in his elements, ascribed the formation of clouds to the refrige-
ıtion arising from the rarefaction of ascending columns of air, and to this
used to advert in my lectures, nearly thirty years ago, using the nephele-
:ope, which I had contrived, as above mentioned, to illustrate the idea.

Thus it became evident, from the experiments and suggestions of Dal-
›n and Davy, that when the different portions of air, in an upward cur-
:nt, successively reach a height sufficient to rarefy and cool them to a
ertain extent, the aqueous vapor which they hold must form a cloud,
nd at the same time render them lighter and warmer than the surround-
ng air.

It was first assumed by Espy that the rise of temperature thus caused,
vould create a buoyancy like that of a balloon, and an upward force,
ınd so great an acceleration as to produce the phenomena of a tornado
t the foot of the column affected. In fact, the buoyancy thus arising is,
y this ingenious author, considered as universally the cause of storms.

Admitting his estimate of the buoyancy consequent to the condensation
vapor to be correct, I aver that no buoyancy thus created in the up-
:r part of an aerial column, would cause any disturbance of the column
:low the level of that upper part.

Count Rumford first showed that water may be boiled at the top of a
ntaining vessel without warming the liquid lying below the part where
e heat may be applied. This fact has been demonstrated by me on a
'ge scale durińg each of thirty courses of lectures. *In Mr. Espy's
esence*, about five years ago, I demonstrated that this law is equally true
the case of air.

A large bell-glass was so supported in an inverted position, as to allow
e axis of a spirit lamp flame to be concentric with the bore of the neck.
the next place, a tuft of cotton, nearly equalling in diameter the mouth
the bell, was moistened with alcohol. By means of tongs, this tuft,
ing held just above the mouth of the bell, was inflamed. Of course,
e difference of temperature thus created was incomparably greater than
y which could be producible by the latent heat yielded by condensing
ıpor. Moreover, the whole lifting influence was concentrated upon the
mparatively narrow area of the bore in the neck; yet the smallest ac-
leration could not be perceived to take place. The flame was not in
ıe slightest degree disturbed. Subsequently, at the meeting of the as-
ciation at Cambridge, in 1849, an apparatus was constructed by which
ıe experiment above described, was repeated with an improved arrange-
ent.

Inside of the inverted bell, so as to cover the bore of the neck imme-

diately over which it rested, a disk of wire gauze was placed, supporti a few thin fibres of carded cotton. About half an inch above the mou of the bell another disk or tray of wire gauze was upheld by appropri means, on which there was put a stratum of carded cotton sufficien copious. These preparations being completed, the cotton above the b was ignited. Notwithstanding the enormous rise of temperature th produced in the upper part of the column of air, of which the low portion occupied the bell glass, so entirely was this lower portion un fluenced that there was not the least perceptible agitation produc among the most delicate fibres of the cotton.

This perfect immobility of the air subjacent to a column of that flu to which a great ascensional power seems to be imparted by the ignit of the cotton, as above described, will not exite wonder, when it is collected that the buoyancy is not the consequence of absolute levi but of comparatively lesser weight. The ascent of a balloon is not spo taneous; it is the effect of coercion. It is forced to ascend by the su rior gravity and consequent pressure of the surrounding air. But wh this displaces the balloon, it does not, on that account, relax its press on the subjacent portion of the atmosphere.

It is admitted, that, on reaching the rarefied region where the atm pheric clouds appear, the consequent condensation of aqueous vapor w make any body of air containing it warmer than it would otherwise l and from the lowest level above which the heat is applied there wo be a more or less disturbance, in consequence of the greater buoyan of the column warmed by the condensation of vapor. But this distu ance would, as I conceive, be much less abrupt and forcible than t Espyan hypothesis of storms requires.

Even after the condensation of aqueous vapor is effected, the wa which formed it will remain within the column, and still add to its weig so that the total weight will not be diminished. Moreover, by swelli upwards, as it naturally will do, towards the region where there is le resistance, it will become as much taller as rarer, and thus compens by its greater height for the loss of specific gravity. In a non-elastic flu any superiority of elevation, in any portion expanded more than the re would be rapidly compensated by the overflow of the excess; but in elastic fluid, where the summit must be so rare as to have scarcely a perceptible weight, no such active overflow can take place as would requisite to produce any violent exchange of position between the colu thus affected and the surrounding portion of the atmosphere.

If, as represented by Espy, all that is requisite to produce a tornado an upward current of air, pre-eminently warm and moist, and penetrati into the region of the clouds, the conditions are abundantly realized the vicinity of the equator. The trade winds have long been ascribed the ascent of air from the regions on each side of the equatorial line, i consequence of the rarefaction arising from a comparatively superior tem perature.

To supply the vertical current thus created, the air is conceived to flo towards the equator from regions more remote, and less heated by th *sun; the currents thus caused being rendered more westerly in thei direction*, relatively to the earth's surface, by the diurnal motion of the

surface, which is necessarily accelerated with the increase of its distance from the terrestrial axis, as the equator is approached. As, in consequence of the warmth to which its ascent is attributed, and an ample contact with the surface, the upward current must be replete with aqueous vapor, all the requisites which the Espyan theory requires for the production of a perpetual gigantic tornado are present; and yet none is produced.

With the hypothesis which ascribes tornados to an electrical discharge, it is quite consistent that there should be no thunder storms within the region of the vertical current, or the trade winds produced thereby, since there is a perpetual discharge by convection, preventing of course any electrical accumulations.

On Certain Points in the Construction of Marine Boilers. By J. Scott Russell, M. Inst. C. E.*

The author having arrived at certain theoretical results relative to the construction of marine boilers, put them into practice about ten years back, in designing the boilers for the Royal Mail Steam Packets *Clyde*, *Tay*, *Tweed*, and *Teviot;* and as they had been in constant work ever since, running from 42,000 miles to 48,000 miles per annum, without material repairs, he believed their durability, combined with effective combustion and economy of fuel, had been fully established. The principles upon which these boilers were constructed differed from those generally recognised. In the first place, it was considered that a judicious distribution of the most intensely heated surfaces would be conducive to durability; and for this purpose, instead of returning the flues over the furnaces, the top of the furnaces and the hottest flues were brought to the surface of the water, and the cooler or return flues were taken to the bottom of the water. The water was admitted at the bottom, and was gradually warmed as it rose, the greatest heat being imparted at the last moment, by which means the bubbles of steam were prevented from accumulating in contact with intensely heated metal. In the next place, the capacity of the furnaces or fire-boxes was unusually large, and their height above the incandescent fuel much greater than usual. The evaporating surface in these boilers was also much more than customary, there being no less than three feet of evaporating surface for every foot of furnace bars. The process of blowing off was provided for by arranging under the flues and furnaces large water spaces, as reservoirs for the collection and blowing off of brine and other deposit.—*Proceed. Inst. Civ. Eng.*, *March* 23.

A Description of a Diaphragm Steam Generator. By M. Boutigny (d'Evreux).†

The principle upon which this steam generator was based, was that "bodies evaporate only from their surfaces." This being received as an axiom, it must necessarily follow that in the construction of steam boilers,

* From the London Civil Engineer and Architect's Journal, April, 1852. † Ibid.

either the evaporating surface of metal should be extended to its utmost limit, or the water should be so divided, and its evaporating surfaces be so multiplied, as to arrive at the same end, of obtaining the greatest amount of steam by the expenditure of the least amount of fuel. The steam generator was described to consist of a vertical cylinder of wrought iron, 25 inches high by 12⅝ inches diameter; the base terminating in a hemispherical end, and the upper part closed by a curved lid, upon which was attached the usual steam and safety valves, feed, steam, and other pipes, &c. The interior contained a series of diaphragms of wrought iron, pierced with a number of fine holes, and having alternately convex and concave surfaces. They were suspended by three iron rods, at given distances apart, in such a manner as not to be in contact with the heated exterior, or shell of the boiler. When any water was admitted through the feed-pipe, it fell upon the upper (convex) disk, which had a tendency to spread it to the periphery, the largest quantity falling through the perforations in the shape of globules; the second diaphragm being concave, tended to direct the fluid from the circumference to the centre, and so on, until, if any fluid reached the bottom of the cylinder, it mingled with a thin film of water, in a high state of ebullition, that being the hottest part of the boiler. It appeared, however, that in its transit through these diaphragms, the water was so divided, that exposing a very large surface to the caloric, it was transformed into steam with great rapidity, and with great economy of fuel. The boiler described had been worked for a long time at Paris with great success, giving motion to a steam engine of two horse power. The consumption of coal was stated to be very small, 789 pounds of water having been converted into steam by 182 pounds of coal in nine hours, under a pressure of ten atmospheres. The chemical part of the question was carefully examined, and it was shown, that at that temperature the iron was exactly in the best condition to bear strain. The practical application on a large scale was submitted to the engineers, the author having only proposed the system for small boilers, and under circumstances of wanting to obtain a motive power in situations of restricted space, and where first cost was a great object.—*Proceed. Inst. Civ. Eng., March* 23.

For the Journal of the Franklin Institute.

On the Telegraphic Lines of the World. By Dr. L. Turnbull.

United States.

In giving an account of the number of telegraphic lines, it will be proper to place the United States as first on the list, from the number and extent of the lines, and from the extensive use made of them in every department, both for business and pleasure. Still, it will be but an approximation to the number, for they are like the spider's web, forming a complete network over the length and breadth of the land, from the extreme north-eastern point to the western boundary of Missouri, adjoining the Indian territory. A continuous line of telegraph *now* extends from the verge of civilization on the western frontier (east

f the Rocky Mountains) to the north-eastern extremity of the United tates; and the time is not far distant when we shall have a telegraph 'om the Mississippi river to San Francisco. This is no fancy sketch, as ıe route is already selected for the California line, and a most interest- ıg Report was presented to the Senate of the United States in the session f 1851, by the Committee on Post Offices and Post Roads.

"The route selected by the Committee is, according to the survey of aptain W. W. Chapman, U. S. Army, one of the best that could be ɪopted, possessing as it does great local advantages. It will commence : the City of Natchez, in the State of Mississippi, running through a well ·ttled portion of Northern Texas, to the town of El Paso, on the Rio rande, in latitude 32°; thence to the junction of the Gila and Colorado vers, crossing at the head of the Gulf of California, to San Diego, on ıe Pacific; thence along the Coast to Monterey and San Francisco. By ıis route, the whole line between the Mississippi River and Pacific cean will be south of latitude 33°; consequently, almost entirely free om the great difficulties to be encountered, owing to the snow and ice ı the Northern route, by the way of the South Pass, crossing the Sierra evada Mountains in latitude 39°. The whole distance from the Missis- ppi to San Francisco will be about 2400 miles."

The great benefits to be derived, the Report fully and ably sets forth, hether in a military, commercial, or social point of view.

"In a commercial point of view, the line in question assumes a gigantic nportance, and presents itself not only in the attitude of a means of com- ıunication between the opposite extremes of a single country, however reat, but as a channel for imparting knowledge between distant parts of ıe earth. With the existing facilities, it requires months to convey in- ırmation from the sunny climes of the East to the less favored, in point f climate, but not less important regions of the West, teeming as they o, with the products of art and enterprise. Let this line of wires be stablished, and the Pacific and Atlantic Oceans become as one, and in- elligence will be conveyed from London to India in a shorter time than ras required ten years since to transmit a letter from New York to Liver- pool."

"Nor does the importance of the undertaking claim less interest, when ·garded in a social point of view. California is being peopled daily and ourly by our friends, our kindred, and our political brethren. The little ands that a few centuries since landed on the Western shores of the tlantic, have now become a mighty nation. The tide of population ıs been rolling onward, increasing as it approached the setting sun, ıtil at length our people look abroad upon the Pacific, and have their ɪmes almost within sight of the spice groves of Japan. Although sepa- ted from us by thousands of miles of distance, they will be again re- ɔred to us in feeling, and still present to our affections, through the help this noiseless tenant of the wilderness."

In the Congressional *Globe* of April 6, 1852, Mr. Douglass presented the emorial of Henry O'Reilly, proposing a system of intercommunication y mail and telegraph, between the Atlantic and Pacific States. All he ks is permission to establish a telegraphic line from the Mississippi Val- ey, where the wires *now terminate*, to the Pacific Ocean, and to be

protected by a line of military posts, so that he can keep up the communication for the benefit both of the Government and of the public. Mr. O'Reilly states in this memorial, that within two years from this time, with this line completed, he would be able to deliver the European news on the shores of the Pacific within one week from the time it left the European Continent. The motion was referred to the Committee on Territories.

These are but a part of the advantages set forth in the bill, with a strong recommendation from the Committee for its passage.

The authorities of Newfoundland have granted to Mr. H. B. Tibbatts and associates, of New York, the exclusive right to construct and use the magnetic telegraph across that island, for the period of thirty years. The grant is designed to facilitate Mr. Tibbatts in his scheme for the establishment of steam and telegraphic communication between New York and Liverpool or London, *in five days*. The telegraph is to extend from New York to St. Johns, from whence a line of steamers is to run to Galway, where another line of telegraph is to commence, extending to London. This latter line will, it is said, be completed during the current year. The distance from St. Johns to Galway is 1647 miles, or about five days' sail.

There are numerous lines in actual and successful operation under the title of Morse, House, and Bain, each giving every facility to the business man.

A recent letter from Charles T. Chester, Esq., Telegraphic Engineer, who is connected with the Morse Line, the first and most extensive one in the United States, gives the following statistics of the facilities for the transmission of intelligence along their lines in the chief cities of this country.

"Two Morse wires run to Boston, three to Buffalo, five to Philadelphia, four to Washington, and two on to New Orleans; on the Western and Canada routes there is generally but one."

The above list will give an approximation of the number of the Morse lines, obtained principally from Mr. Chester, and from the work of Disturnell, published January, 1852. The following is a list of the names of the Companies:

1. Washington and New Orleans Telegraph, organized under Morse's patent; tariff of charges, $2; from Washington to New Orleans, 1716 miles, with 19 stations; no charge for address, signature, or date; Daniel Griffin, Esq., President.

2. Atlantic and Ohio Telegraph Line; Philadelphia office, 101 Chesnut street; tariff of charges, $1·30 to Milwaukie, Wis.; from Philadelphia to Milwaukie, 812 miles, with 76 stations.

3. The Magnetic Telegraph Company Line, extending from New York to Washington City; office, No. 5, Hanover street, corner of Beaver street, New York; rates of charges, 50 cents; from New York to Washington, 245 miles, with 10 stations. Also, from New York to New Orleans, $2·50; but when a communication exceeds 100 words, the price on all words exceeding that number will be reduced one-third.

4. New York, Albany, and Buffalo Telegraph; office, No. 16, Wall street, New York, up stairs; from New York to Niagara, 500 miles; 65 *cents*. This line connects with numerous towns and cities in Vermont, *Canada*, Pennsylvania, Ohio, Michigan, Indiana, Illinois, Wisconsin, *Iowa*, *Tennessee*, and Kentucky; with 76 stations.

5. Troy and Canada Telegraph; from Troy to Montreal, with 14 stations.
6. Magnetic Telegraph Line, from Boston to Halifax, N. S., with 12 stations.
7. New York and Boston Magnetic Telegraph Association, organized under Morse's patent; office, No. 5, Hanover street, near Beaver street, New York; from Boston, Mass., to Halifax, N. S.; with 35 stations. Also, from New York, via Bridgeport, to Birmingham, Conn.; with 11 stations; 50 cents for 10 words.

The first American telegraphic line was established in May, 1844, between Washington and Baltimore, over a length of 40 miles.

The line from Washington to Baltimore also proceeds to Philadelphia and New York, over an extent of 250 miles. It reached Boston in 1845, and became the great line of the North, from which branched two others: one, the length of 1000 miles, from Philadelphia to Harrisburg, Lancaster, Pittsburg, Ohio, Columbus, Cincinnati, Louisville (Kentucky), and St. Louis (Missouri); the other, the length of 1300 miles, from New York to Albany, Troy, Utica, Rochester, Buffalo, Erie, Cleveland (Ohio), Chicago (Illinois), and Milwaukie (Wisconsin).

A fourth line goes from Buffalo to Lockport, Queenstown, the Lakes Ontario and Erie, the Cataracts of Niagara, Toronto, Kingston, Montreal, Quebec, Halifax, and the Atlantic Ocean, over an extent of 1395 miles.

Two lines South; one from Columbus to New Orleans, by Cincinnati; the other from Washington to New Orleans, by Fredericksburg, Charleston, Savannah, and Mobile. The first is 1200 miles long, the second 1122 miles. This line has been extended West to Independence, Missouri.

In April, 1852, direct communication was had between the New Orleans Telegraph office and the office of the New Orleans line in Hanover street, New York, the whole extent of near 3000 miles of wire having been successfully worked in a single circuit. Despatches were sent from New York to New Orleans sixty minutes ahead of time.

The House Printing Telegraph has only been in operation since 1846, but even in that short time has spread itself over a large portion of the United States, working to the entire satisfaction of our business community, and wherever found, exciting the admiration of the curious, being able to print in Roman capitals communications in almost every language.

This line consists of the Boston and New York Telegraph Company, using the House Printing Telegraph; about 600 miles of wire, two wires; stations at Boston, Mass.; Providence, R. I.; Springfield, Mass.; Hartford, Conn.; New Haven, and New York.

A line is being constructed to connect with this Boston line, running from Springfield, Mass., to Albany, N. Y.; there to intersect the New York and Buffalo line, using the same instruments, extending from New York to Buffalo, a distance of 570 miles. One wire is now in operation, connecting with Poughkeepsie, Troy, Albany, Utica, Syracuse, Lyons, Rochester, Albion, Lockport, and Buffalo; and another wire, nearly completed the same distance. This line is to continue to St. Louis, Mo., connecting with Cleveland, Cincinnati, Louisville, and St. Louis, which will be completed the entire distance in 1852; forming the longest line in the

world under the direction of one company, the whole length being 1500 miles.

The New Jersey Magnetic Telegraph Company, using the House instruments, and the first line of this kind ever put in operation, extends from Philadelphia to New York; one wire, 132 miles; and another now being put up. For this information, I am indebted to the politeness of William J. Philips, Esq., Telegraphic Engineer on the House line at Philadelphia.

Making the whole number of miles 2802; rate, 25 cents for the first ten words from Philadelphia to New York.

The Atlantic and Pacific Telegraph range, under the arrangement of Henry O'Reilly, Esq., using a modification of Bain's Chemical Telegraph and Morse's instrument, from New York to Washington, and from New York to Boston. Also, the first division, constructed eastward of the Mississippi, known as the "Atlantic, Lake, and Mississippi Telegraph," extending to the Atlantic, and connecting nearly all principal cities and towns between the Canadian frontier and the Mexican Gulf—embracing the Ohio and Mississippi vallies, as well as the Lake country; about 6000 miles constructed, and 3000 miles contracted for construction.

The second division, westward of the Mississippi, to include the "Mississippi and Pacific Telegraph," of which about 500 miles of river distance, embracing the principal towns along the Missouri, between St. Louis and Fort Leavenworth, is contracted for construction, additional to other extensions in different quarters, west of the Mississippi, to be extended from Fort Leavenworth to San Francisco, when Congress authorizes the extension through the public domain.

The Bain Line, now a Morse Line, Mr. Henry J. Rodgers, General Superintendant from New York to Washington, has lately constructed, at an expense of $10,000, spars 310 feet high, at the Palisades and Fort Washington, ten miles above the City of New York, for the purpose of sustaining their wires over the river, instead of the method formerly employed, by passing the current through the water, by wires laid across the North River. He considers this method, by means of suspension on spars, as being more permanent and durable. The price of telegraphic despatches by this line is the same as the others. They have offices in Boston, Providence, New York, Philadelphia, Wilmington, Baltimore, and Washington.

The Bain Lines in the United States are as follows:

One from Louisville to Memphis, called an O'Reilly Line, and contemplate using the same instrument to New Orleans on the same line.

One from New York to Boston; 2 wires.

One from Boston to Portland, Me.

And one from New York to Buffalo; 2 wires.

The profits to the stockholders amount to from three to six per cent. per annum. The usual expense of constructing these lines varies from $100 to $200 per mile.

List of the Morse Telegraph Lines in the United States.

		MILES.
1.	Washington to New Orleans, by way of Richmond, Va.,	1,716
2.	Washington to New York, by way of Baltimore and Philadelphia, 5 lines, each 250 miles,	1,250
3.	Harper's Ferry to Winchester, Va.,	32
4.	Baltimore, by way of Pittsburg and Wheeling, to Cumberland,	324
5.	Baltimore to Harrisburg, by way of York, Pa.,	72
6.	York to Lancaster, by way of Columbia, Pa.,	22
7.	Philadelphia to Lewistown, Del.,	12
8.	Philadelphia to New York, 6 lines, each 120 miles,	720
9.	Philadelphia to Pittsburg, by way of Harrisburg,	309
10.	Philadelphia to Pottsville, by way of Reading,	98
11.	Reading to Harrisburg,	51
12.	New York to Boston, by way of New Haven, &c., 2 lines, each 240 miles,	480
13.	New York to Buffalo, by way of Troy and Albany, 5 lines, each 500 miles,	2,500
14.	New York to Fredonia, N. Y., by way of Lake Erie, Newburg, and Oswego,	450
15.	Bridgeport, Conn., to Bennington, Vt., by way of Pittsfield,	150
16.	Boston to Newburyport, by way of Salem, Mass.,	34
17.	Boston to Portland, by way of Dover,	110
18.	Worcester to New Bedford, by way of Providence,	97
19.	Worcester to New London, by way of Norwich,	74
20.	Portland to Calais, Me.,	260
21.	Calais to St. Johns, N. B.,	75
22.	Troy to Whitehall, by way of Salem,	72
23.	Troy to Montreal, Canada, by way of Rutland and Burlington,	278
24.	Syracuse to Oswego, N. Y.,	38
25.	Auburn to Elmira, by way of Ithaca, N. Y.,	75
26.	Binghampton to Ithaca, by way of Oswego, N. Y.,	48
27.	Buffalo to Queenston, Canada, by way of Lockport,	48
28.	Buffalo to Milwaukie, Wis., by way of Lake Erie and Chicago, Ill.,	812
29.	Queenston to Montreal, by way of Toronto and Kingston,	466
30.	Montreal to Quebec,	180
31.	Cleveland to Pittsburg, by way of Alton, Ill.,	150
32.	Pittsburg to Cincinnati, O., by way of Columbus,	310
33.	Pittsburg to Columbus,	680
34.	Columbia to Memphis, Tenn., by way of Wheeling,	205
35.	Columbia to New Orleans, by way of Tuscumbia and Natchez,	638
36.	New Orleans to Balize, at the mouth of the Mississippi,	90
37.	Columbia to Chilicothe, Ohio,	45
38.	Cincinnati, Ohio, to Maysville, Ky., by way of Ripley,	60
39.	Cincinnati to St. Louis, Mo., by way of Vincennes,	410
40.	St. Louis to Chicago, by way of Alton, Ill.,	330
41.	Alton to Galena, by way of Quincy,	380
42.	Quebec to Halifax,	700
43.	St Louis to Independence, Mo.,	25
44.	New York to New Orleans,	3,000
	Total,	17,283

Making in all the lines—

House Line,	2,802	miles.
O'Reilly Line, using in most of the offices the modified Bain instrument—part of the O'Reilly Lines using the Morse instrument,	6,000	"
Morse Line,	17,283	"
Bain Line,	1,092	"
Total number of miles in the United States,	27,177	

(To be Continued.)

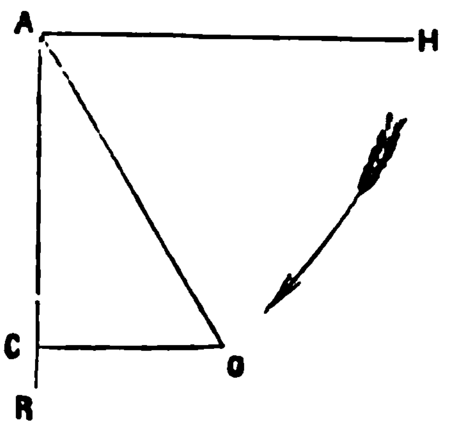
For the Journal of the Franklin Institute.

On Oblique Action. By T. W. Bakewell, Esq.

In the following remarks, "loss of power" means inefficient consumption of steam; in other words, power and steam are used synonymously.

A *gain* of power by any obliquity of forces (or vision,) has ceased to be orthodox; but a *loss* therefrom still lingers as canonical.

A loss of power is ascribed to oblique action on the water in some positions of the arm of side wheel steamers; and truly, there is a small loss by oblique over direct action on the water which will be noticed below; but that is not the loss in question.



Let A R be the vertical arm of the wheel, pressed by the force from the engine, against an unyielding object at R; the advance of the vessel would be the measure of the power or steam used.

Let A H be the horizontal arm, opposed at H by an unyielding object; then, as there is no advance of the vessel, no power is used, and no mechanical effect produced.

Hence, it is evident, that at any position between the vertical and horizontal, the arm being in like manner opposed by an unyielding object; the expenditure of steam would be restricted to that part of the force tending to propel the vessel, and the other portion tending to raise the vessel would be reserved.

The reservation of steam, implies a *pro tanto* loss of time, and although not the point under discussion, may bear a remark. The course of action with a crank and connecting rod, shortening the leverage as the dead point is approached, is precisely similar to the mode of decrease of propelling power as the arm of the wheel approaches its dead point at A H.

This apparent loss of time by the retention of steam, is with the wheel as with the crank, obviated simply by the steam "getting stronger."

An oblique arm cannot annihilate or dispose of the power given out to it by the engine, except by advance of the vessel, or slip of the paddle; otherwise, we might anchor a vessel in the current, and make the wheel the motor to the cylinder converted into a double acting force pump; when that position of the former power from the cylinder which was nullified by obliquity, would become a gain to the wheel of equal amount.

The loss in practice which occurs from oblique action, arises from the loss by slip of the paddle through the water becoming *proportionably* greater, as the propelling part of the force decreases by obliquity.

The loss from this source is dependent on size of wheel and paddle, force applied, &c., and the following merely exhibits the governing principle:

The propelling effect is as the cosine directly, and the loss by slip, as the cosine inversely, where A R, radius $=1$; then to the vertical arm A R, with a propelling effect $=1$, there is a loss by slip of say 20 per cent. to the oblique arm A O, (at 30°); with a propelling effect as cosine $A\,C = \cdot 866$, there would be a proportional loss of 23 per cent. In actual

practice, however, the above increase of 3 per cent. loss, seemingly due to the oblique arm, is much reduced by partial immersion, and by the reciprocally neutralizing motions of the wheel backwards, and the vessel forwards, causing the paddle to enter the water nearly edgewise, and to be withdrawn in the same manner after passing the vertical.

A frequent contributor to the Journal on this subject, in giving details of marine engines and their effects, generally places the loss by oblique action in side wheel steamers (exclusive of slip,) at 12 to 17 per cent., but in similar details with screw propellers where the action is entirely oblique, this item is omitted.

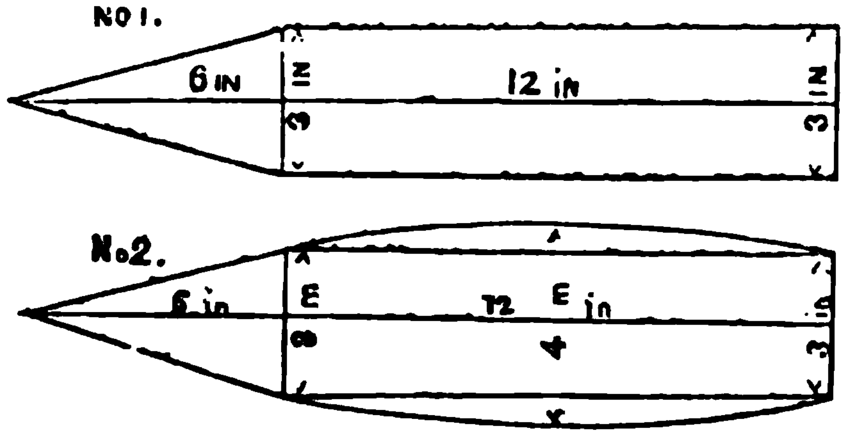
Cincinnati, June, 1852.

Hints on the Principles which should regulate the Forms of Boats and Ships, derived from original Experiments. By MR. WILLIAM BLAND, *of Sittingbourne, Kent.**

Continued from vol. xxiii, page 358.

CHAPTER VII.—EXPERIMENTS RELATING TO THE MIDDLE.

The segment of a circle, which subtends ¼-inch in the centre of a base line of 6 inches, having proved beneficial towards the promotion of speed when applied at the bows, as given in Experiment 10, and at the stern in Experiment 24, induced a further trial of the same curve in the experiments annexed:



Scale, ¼-inch to 1 inch.

Experiment 28.—The two models (Nos. 1 and 2) of the same bows, length, and weight, but differing in their sides, one being parallel, the other convexed; the rise at mid-length being ½-inch to the whole length of side of 12 inches, according to the proportions before adopted.

Upon being tried against each other at the ends of the balance-rod, it appeared that the speeds were equal. This makes a third instance of the good qualities of the curve in the promotion of speed over the straight line.

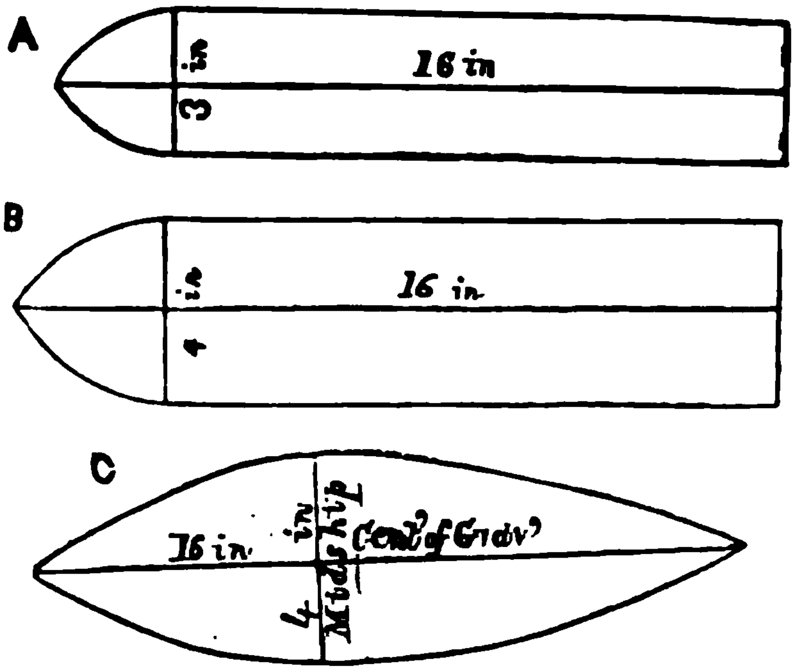
In this experiment is seen greater breadth of beam, equal indeed to one-fourth; yet, by the adoption of the curve in question, equal speed is obtained.

Experiment 29.—Segments of circles of different diameters were further applied and tested against two parallel-sided models; one of the same

* From the London Architect for September, 1851.

breadth of beam, the other of less beam by one-fourth part; all three, however, of the same weight, 23 oz.

Scale, ⅛-inch to 1 inch; thickness, 2 inches.



Modelled from the horizontal section of the sole fish.

The first trial took place between the models A and C. The result gave the speed of C to be greater than A, in the proportion of 5 : 4; or taken in weight, equal to 8 oz.; because the model C required to be loaded with that weight extra, to retard its speed to an equality with the speed of A.

Experiment 30.—The second trial was between the models A and B. In this instance, the speed of A beat that of B, by the extra weight of 4 oz.

Experiment 31.—In the third trial, the speed of the model C beat that of the model B, by 12 oz. extra weight.

Experiment 32.—The model C was drawn through the water, having its stern or sharper end foremost, and in consequence of so doing, the speed was reduced. Moreover, by the sharper end going foremost, the steadiness of its course was in a great measure destroyed, the model requiring a piece of keel to be attached at the aft end to cause the body to preserve a straight course; and which was not found necessary when the bluffer end or bows met the water when floating upon an even keel.

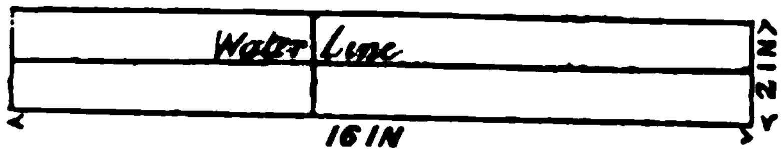
The inference to be drawn from the last four experiments is in every respect in favor of the bird or duck shaped model C; at the same time pointing out the wisdom of preferring the bluffer or larger end to go foremost, rather than the sharper end.

Chapter VIII.

The subjoined experiments were undertaken to ascertain the effects of cutting inclined up of vessels from the midship section, both to the head and stern. To this end, three models were made of the precise form and size of C in the preceding chapter, with the exception of their being varied from it as delineated below, scale ⅛-inch to 1 inch.

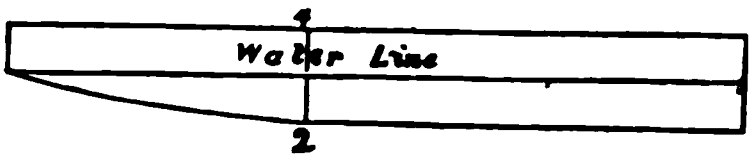
The inclination upwards, or curves at both the bows and stern of these diagrams, are sections of two circles, having their centres in the same straight line (numbered 2, 4,) at the midship sections of the diagrams, when produced indefinitely in the direction of 2, 4; and their circumferences passing through the points 1 and 2, 2 and 3.

Experiment 33.—The models C and D being first made of equal weight, were tested as to their speed; and it was found that the model D with its bows cut inclined up, beat C with the level bottom by 8 oz. additional weight.



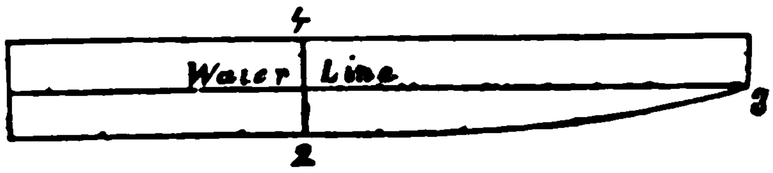
Side view of model C.—Weight 22 oz.

D



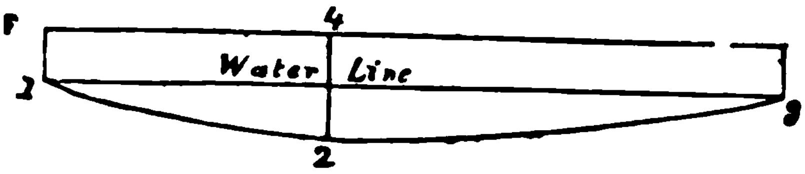
The model with the bows from 1 to 2, cut inclined up.

E



The model with the stern from 2 to 3, cut inclined up.

F



The model with both the bows and stern cut inclined up.

Experiment 34.—Next, the model C was tested with E, having its stern cut inclined up; when C was again beaten in its speed, the model E carrying with equal speed 6 oz. extra weight.

Experiment 35.—After this, the two models D and E were tried against each other, and the advantage in speed was, in weight, 2 oz. on the side of the model D.

Experiment 36.—Lastly, the models C and F were put upon the water together, the latter having both its bows and stern cut inclined up. The difference in their speed was altogether in favor of F; indeed, equal to 12 oz. or more, for this extra weight was not sufficient when put into F, to equalize the speed of the two models, but the great weight F already carried was quite load enough, without sinking too deep into the water.

The conclusion to be drawn here is, the positive good effects from the cutting or curving up of both the head and stern of vessels, when commenced from the midship section, and extending as far at least, each way, as the load water-line.

(To be Continued.)

For the Journal of the Franklin Institute.

Notes on the U. S. Surveying Steamer Walker. By B. F. Isherwood, Chief Engineer, U. S. Navy.—(*With a Plate.*)

The *Walker* was one of the batch of eight iron revenue steamers, commenced in 1843, for the Treasury Department. She was built at Pittsburg, Pennsylvania, by J. Tomlinson, and was one of the two originally fitted with paddle wheels. The experiment tried by the Treasury, of substituting steam for sailing cutters, having signally failed from the too large size of the steamers, the expense of maintaining them, and the

abortive character of their machinery and propelling instruments, they were either turned over to the Coast Survey, or otherwise disposed of. Of the eight, only three now remain in the Government service, viz: the *Legarè*, the *Bibb*, and the *Walker*, and they are employed as Surveying Steamers.

During the present year, the *Walker* has been refitted with new boilers at the works of Messrs. Merrick & Son, Philadelphia. The dimensions of the vessel, machinery, &c., are now as follows:

Hull.

Length between perpendiculars, . .	132 feet.
Beam extreme, . . .	24 " 6 inches.
Depth of hold, . . .	11 " 3
Mean draft of water for all the steaming done, .	9 " 8
Burthen, . . .	305 tons.
Immersed amidship section at 9¾ feet draft, .	193 square feet.
Square feet of immersed amidship section, per cubic foot of space displacement of pistons, . . .	2·708 to 1·000
Square feet of immersed amidship section, per cubic foot of space displacement of pistons, multiplied by number (22) of double strokes of piston per minute, . .	0·123 to 1·000

Engines.

Two horizontal, half beam, condensing engines, Lighthall's patent.

Diameter of steam cylinders, . .	2 feet 9 inches.
Stroke of steam piston, . .	6 "
Diameter of air pumps, . . .	2 " 8 "
Stroke of air pump piston, . .	1 " 4 "
Space displacement of steam pistons per stroke, .	71·274 cubic feet.
Space displacement of air pump pistons per stroke,	14·893 " "
Mean effective pressure by indicator on piston per square inch, (steam pressure in boiler 11·3 pounds, cutting off at half stroke, throttle one-third open, being average of all steaming done,)	13¼ pounds.
Double strokes of piston under above conditions per minute,	22
Horses power developed by engines under above conditions,	181·26

Paddle Wheels.

Diameter from outside to outside of paddles, .	16 feet.
Length of paddle, . .	6 "
Breadth of paddle, . . .	2 "
Immersion of lower edge of paddle at 9¾ feet draft of vessel,	4 "
Area of two paddles, . .	24 "
Number of paddles in each wheel, . .	12 "
Number of paddles in each wheel in water at 9¾ feet draft of vessel, . . .	3 "
Proportion of the area of two paddles to immersed amidship section of hull, . . .	1.000 to 8·042
Proportion of the area of all the immersed paddles to immersed amidship section of hull, . .	1.000 to 2·681
Loss of effect by oblique action of the paddles, calculated as the squares of the sines of their angles of incidence on the water,	21·64 per cent.
Slip of centre effort of paddles with 22 revolutions of wheels per minute, and 7 knots speed of vessel, . .	30·38 per cent.

Boilers. *Plate I.*

Two iron boilers with single return ascending flues; boilers placed side by side.

Length of each boiler, (exclusive of projection of steam chimney=7 inches,) . .	15 feet 2 inches.
Breadth of each boiler, (exclusive of projection of steam chimney=8 inches,) . . .	7 " 0 "
Height of each boiler, (exclusive of additional height of steam chimney=6 feet 7 inches,) .	9 " 3 "
Contents of circumscribing parallelogram of each boiler, (exclusive of steam chimney,) . .	982·04 cubic feet.

Total area of grate surface in both boilers, . .	57·5 square feet.
Total area of heating surface in both boilers, .	1280· "
Capacity of steam room in both boilers and steam chimney,	541· cubic feet.
Capacity of steam room in boilers, steam chimney, and steam pipe, ...	570· "
Cross area of the lower row of flues in both boilers,	10·123 sq. feet.
Cross area of the two upper rows of flues in both boilers,	13·090 "
Cross area of smoke pipe, . . .	12·566 "
Height of smoke pipe above grates, .	40 feet.
Mean pressure of steam above atmosphere in boiler per square inch, throttle $\frac{1}{3}$d open, cutting off at $\frac{1}{2}$, making 22 double strokes of piston per minute, giving 7 knots speed to vessel, being the general average of all steaming done,	11·3 pounds.
Mean initial pressure of steam in cylinder per square inch above atmosphere by indicator under above conditions,	6·3 "
Space comprised between cut-off valve and piston, (both cylin's,)	8·563 cu. feet.
Consumption of anthracite coal per hour, with very moderate fan blast, under above conditions, . .	840 pounds.

PROPORTIONS.

Proportion of heating to grate surface, . .	22·261 to 1·000
" grate surface to cross area of lower row of flues,	5·681 "
" " " the two upper rows of flues,	4·393 "
" " " smoke pipe, .	4·576 "
" heating surface to cross area of lower row of flues,	126·445 "
" " " the two upper rows of flues,	97·784 "
" " " smoke pipe,	101·862 "
Square feet of heating surface per cubic foot of space displacement of pistons, . . .	17·958
Square feet of heating surface per cubic foot of space displacement of pistons per double stroke of piston (22) per minute,	0·816
Square feet of grate surface per cubic foot of space displacement of pistons, . . .	0·807
Square feet of grate surface per cubic foot of space displacement of pistons per double stroke of piston (22) per minute,	0·037
Cubic feet of steam room per cubic foot of steam used per stroke of pistons, . . .	12·900
Consumption of anthracite coal with very moderate fan blast per square foot of grate surface per hour, .	14·609 pounds.
Consumption of anthracite coal with very moderate fan blast per square foot of heating surface per hour, .	0·656 "
Weight of steam produced per hour from water at a temperature of 100° F., by one pound of anthracite coal, exclusive of the steam required to work the fan blast, but inclusive of loss by blowing off, so as to keep the sea water at twice the natural density, of loss in nozzles, clearance, &c., taking the total cylinder pressure at 21 pounds per square inch, cutting off at half stroke, making 22 double strokes of pistons per minute, and burning 840 pounds anthracite per hour,	8·008 "
Weight of steam produced per hour from one square foot of heating surface under above conditions, . .	5·255 "

PERFORMANCE.

The general mean of all steaming done at sea is, per hour, 7 knots of 82¾ feet each—a very low speed, when the consumption of fuel (840 unds of anthracite per hour) is considered, in connexion with the dinsions of the vessel. A portion of this low result is undoubtedly due the proportions of the wheel, which are of the common radial kind, which, with a radius of only 8 feet, have the enormous immersion of feet. When the vessel is rolling in an ordinary sea, or when she is

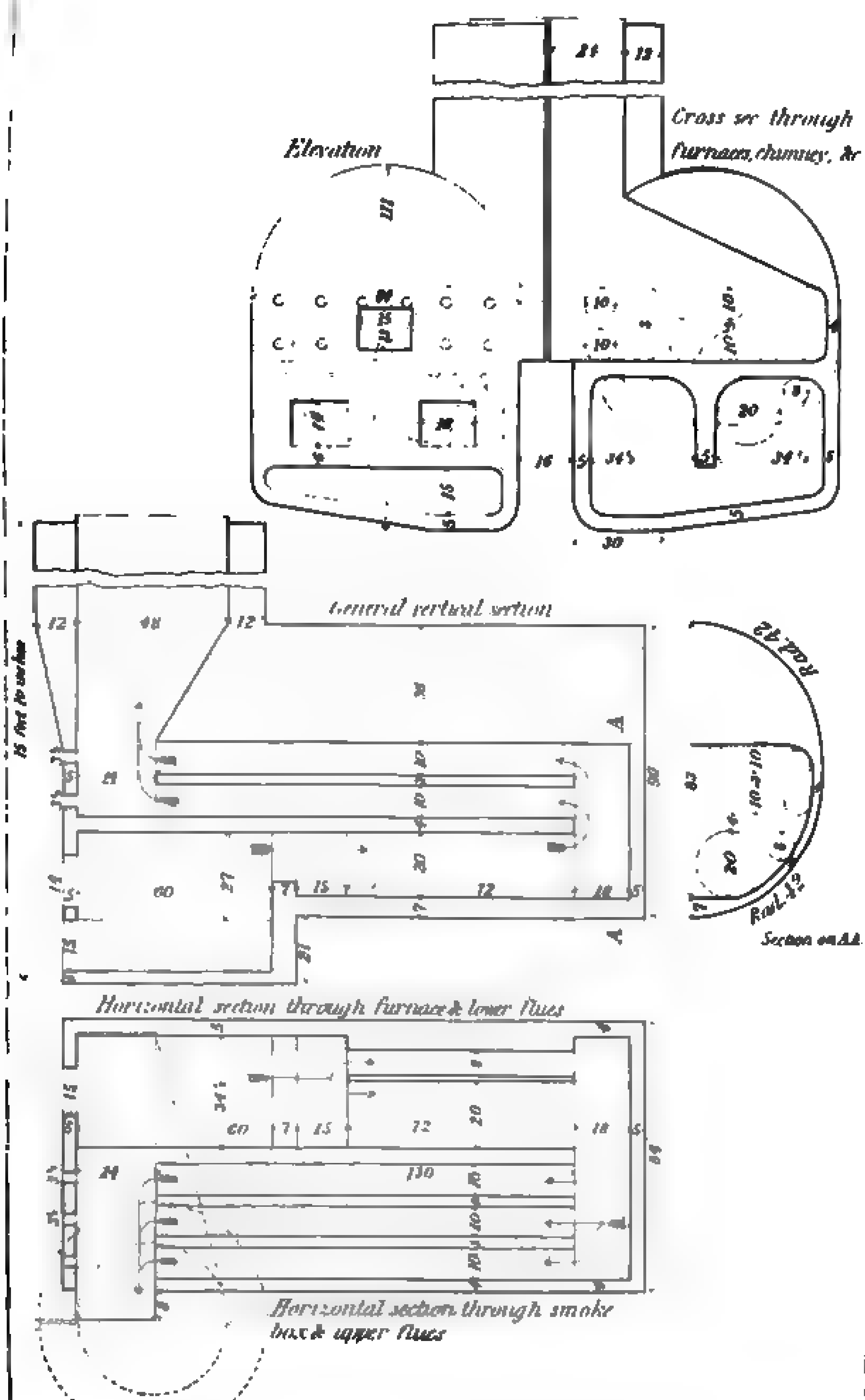
careened a little ($7\frac{1}{2}^\circ$ from the horizontal) by sail, one wheel is immersed to the axis. In such a case, the loss of effect by the oblique action of the paddles is vastly greater than its calculated per centage for the average immersion of both wheels; while the slip of the two wheels remains about the same, the increased resistance of the deeper water to the depressed wheel, about balancing its decreased resistance to the lifted wheel. The absolute amount of paddle surface was also considerably too small. For a vessel of the *Walker's* size, the paddles should have been 7 feet long instead of 6 feet; and the wheel 19 feet diameter, instead of 16 feet, retaining nearly the same immersion as at present. The paddles on the present wheel are at the periphery about 4 feet 2 inches apart, which distance, for a sea-going vessel with so small a wheel, may be considered too great.

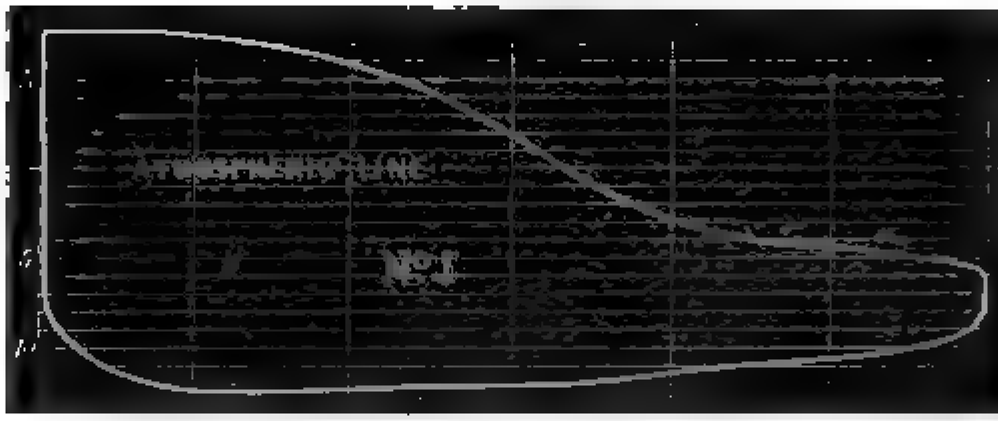
Of capacity of steam cylinders, there was a superabundance, but the boiler was too small to supply the intended quantity of steam, 15 pounds pressure per square inch above the atmosphere, cutting off at half stroke. Using the fan blast moderately, the boilers could with difficulty maintain an initial cylinder pressure of 6·3 pounds per square inch above atmosphere, burning 14·609 pounds of anthracite per square foot of grate per hour. The boilers were, however, well proportioned, giving the high evaporation of 8·008 pounds of steam per pound of coal, exclusive of the steam used for working the fan blast. This high evaporation may, I think, justly be attributed to the excellent proportions between the calorimeter (cross area of flues) and grate surface, and between the heating and grate surface. The least calorimeter was to the grate surface in the proportion of 1·000 to 5·681; while the heating was to the grate surface as 22·261 to 1·000. The disadvantage of a smoke pipe not high enough for good results with anthracite was compensated by a moderate fan blast. With a natural draft, the grates would consume 650 pounds of anthracite per hour, or 11·3 pounds per square foot. The advantages of a large calorimeter, are well illustrated in this boiler, proving beside, the high evaporative power of anthracite.

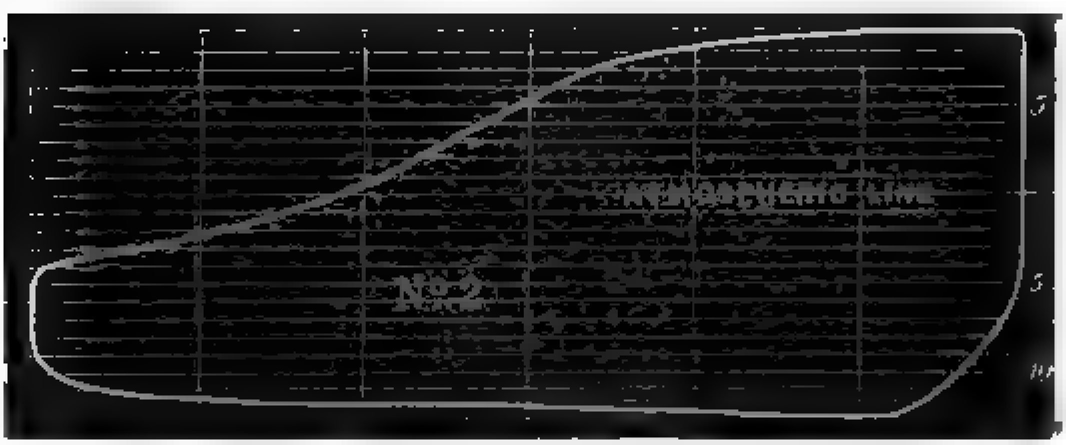
Indicator diagrams, Nos. 1 and 2, were taken nearly simultaneously from the front and back ends of the *starboard* cylinder. In No. 1, the mean effective pressure per square inch of piston was 12·83 pounds; in No. 2 it was 15·33 pounds; the boiler pressure being the same in both, viz: 10 pounds per square inch above the atmosphere; double strokes of piston, $22\frac{1}{2}$ per minute.

Indicator diagrams, Nos. 3 and 4, were taken immediately after Nos. 1 and 2, from the front and back ends of the *port* cylinder. In No. 3 the mean effective pressure per square inch of piston was 10·17 pounds; the boiler pressure being 11 pounds per square inch above atmosphere; double strokes of piston, 23 per minute. In No. 4, the mean effective pressure per square inch of piston was 12·67 pounds, the boiler pressure being 9 pounds per square inch above atmosphere; double strokes of piston, 22 per minute. In all four diagrams, the vacuum per gauge in condenser was 27 inches of mercury, and the throttle one-third open; steam being cut off at half stroke. These diagrams show in a very marked manner, the effect of throttling. They also show that the exhaust valve closed when the piston had yet about one foot of its stroke to perform, cushioning the steam through that distance, and that the steam valve had no lead.

Boilers of the U.S. Steamer "Walker."

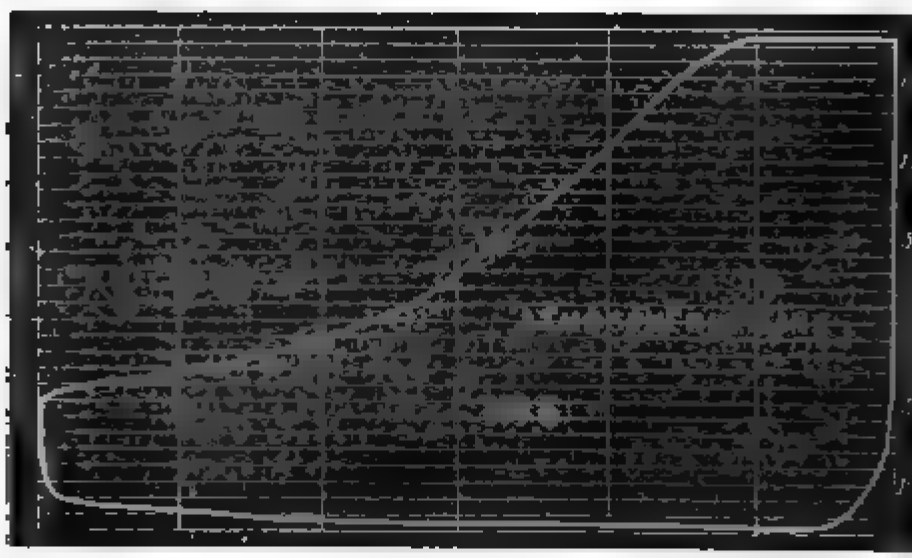



ATMOSPHERIC LINE
No. 1


ATMOSPHERIC LINE
No. 2


ATMOSPHERIC LINE
No. 3


ATMOSPHERIC LINE



anner of using steam proving unsatisfactory, the cylinders were as shown in indicator diagrams, Nos. 5, 6, 7, and 8. Nos. 5 and taken in succession from the front and back ends of the *starboard* r; the steam pressure in boiler per square inch above atmosphere pectively 15 and 18 pounds; double strokes of piston, 21 per In No. 5, the mean effective pressure per square inch of piston was nds; in No. 6, 17·33 pounds; the steam in starboard cylinder was at one-sixth the stroke from the commencement.

7 and 8 were taken immediately after Nos. 5 and 6, from the front ck ends of the *port* cylinder; the steam pressure in boiler per inch above atmosphere was respectively 16 and 17 pounds; double of piston, 21 per minute. In No. 7 the mean effective pressure are inch of piston was 13.33 pounds; in No. 8, 14·83 pounds; the n port cylinder was cut off at one-ninth the stroke from the comnent. In all of these diagrams the vacuum in condenser per was 28 inches of mercury; throttle wide open.

e no account of the fuel now used, but am informed that no diffifound in keeping steam; the corners of the diagrams are also quarer than before, and the expansion curve shows the cylinder which were of the "balance puppet" kind, to have been tight.

For the Journal of the Franklin Institute.

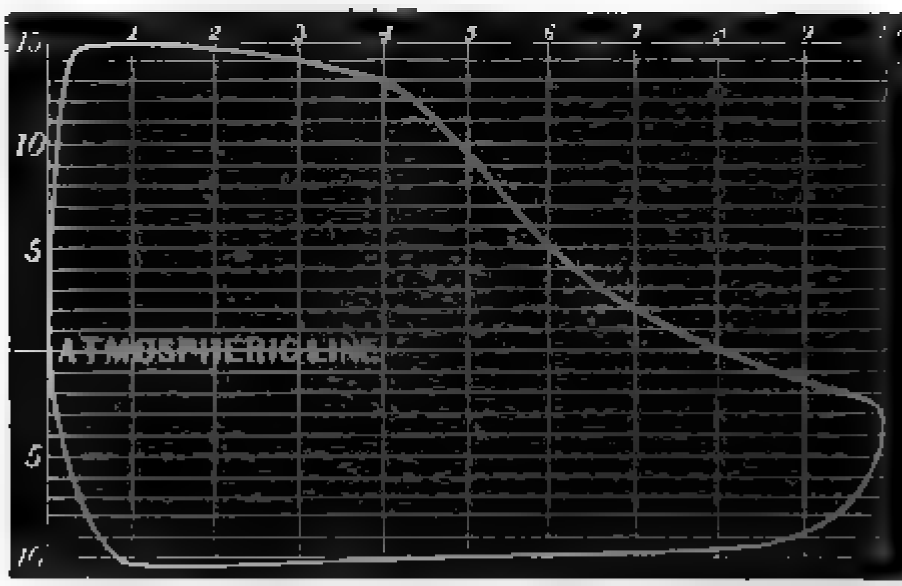
ance of the U. S. Mail Steamer Arctic, on her Eighth Voyage from fork to Liverpool. By B. F. Isherwood, Chief Eng. U. S. Navy.

ate. 852.	Average steam pressure in boiler. Pounds per sq. in.	Average revolutions per minute.	Total revolutions made per day.	Time h. m.	Anthracite coal. Tons burn'd per day.	Geographical miles ran per day.
b. 8th.	17·0	14·5	20,550	23 45	85	300
9th.	16·7	14·3	20,167	23 30	75	310
10th.	17·5	15·3	21,704	23 34	80	325
11th.	17·5	15·8	22,419	23 30	88	331
12th.	17·0	15·7	22,254	23 25	89	336
13th.	16·1	15·3	21,497	23 31	89	234
14th.	17·0	16·4	23,104	23 25	92	316
15th.	17·0	16·7	23,440	23 23	90	307
16th.	16·7	16·5	23,237	23 22	91	301
17th.	16·5	17·5	22,594	21 25	87	295
als,			220,966	d. h. m. 9 16 41	866	3055
ns,	16·9	15·827			8337·3 lbs. per hour.	13·13 pr h'r.

tor Diagram.—The accompanying indicator diagram shows the rformance. When taken, steam pressure in boiler above atmos-

phere per square inch, 17 pounds; double strokes of piston per minute, 16; mean effective pressure on piston throughout the stroke, 16·9 pounds; throttle partly closed; calculating the horse power developed by the engine for this pressure and for 15·827 double strokes of piston per minute, we have, area of both pistons, 14176·46 square inches; stroke of piston, 10 feet; mean effective pressure per square inch of pistons, 16·9 pounds; speed of piston per minute, 316·54 feet.

$$\frac{14176 \cdot 46 \times 16 \cdot 9 \times 316 \cdot 54}{33000} = 2298 \cdot 1 \text{ horse power.}$$



Evaporation by the Boilers.—The mean initial steam pressure in the boilers may be taken at 14·3 pounds per square inch above atmosphere, cut off at $4\frac{1}{2}$ feet from commencement of stroke of piston. Space displacement of both pistons filled per stroke with steam, 443·016 cubic feet, to which add space comprised between cut off valve and piston at one end of cylinder, (for both cylinders,) 25 cubic feet, making a total bulk of 468·016 cubic feet of steam of the total pressure of 29 pounds per square inch, used per stroke of piston, which per hour would become $(468 \cdot 016 \times 15 \cdot 827 \times 2 \times 60)$ 888874·708.

The loss by *blowing off* at $\frac{2}{32}$, will be as follows: neglecting small corrections, total heat of steam, 1202° F.; temperature of feed water, 100°F.; temperature of steam of 29 pounds total pressure, 249·6°; then, 1202° —100° = 1102°; and, 249°·6—100 = 149·6°. Sum of the caloric utilized in steam and lost in *blowing off*, (1102°+149°·6)1251°·6, of which 1102° is 88 per cent. and $\frac{888874 \cdot 708 \times 100}{88} = 1010084 \cdot 9$ total cubic feet of steam of 29 pounds total pressure generated per hour. The relative volumes of this steam and the water from which it is generated, is 911· and 1, and $\frac{1010084 \cdot 9}{911} = 1108 \cdot 765$ cubic feet of sea water evaporated per hour, which at 64·3 pounds per cubic foot, would amount to 71293·59 pounds of water evaporated per hour by 8337·3 pounds of anthracite, or 8·55 pounds of water per pound of coal.

This is perhaps a higher result than has ever before been attained by a marine boiler making a long trip, and fired and cleaned in the ordinary manner by ordinary firemen. It will be observed that the results obtained

ıder the above practical conditions, are very different from what would given by a more experimental trial of a few hours on shore, with a ıall quantity of fuel skilfully burned, and all avenues of losses carefully arded. It must also be considered that these boilers have been in use · some time, and are probably considerably encrusted with scale.

The features of these boilers are, 1st, The heating surface is nearly all rtical surface.

2d, The proportion of calorimeter or draft area to the grate surface is ry large at first, and diminishes to nearly one half in the chimney, ing at front of tubes, 1·000 to 5·205; at back of tubes, 1·000 to 7·840; chimney, 1·000 to 10·000.

3d, The proportion of heating to grate surface is very large, being $\frac{1}{4}$ to 1.

4th, The hot gases are kept by means of a hanging bridge in contact th the heating surface, until their temperature is properly reduced.

5th, A very great height of chimney, being 75 feet above grates, ring a good draft even with the greatly diminished chimney calorimeters; rapidity of the combustion is not remarkable as either fast or slow, ing at the rate of 13·13 pounds of coal per square foot of grate per hour.

6th, A double tier of furnaces, one furnace in the upper and one in lower tier, mingle their hot gases at the same bridge. By alternate ing below and above, the temperature of the mingled gases is always pt sufficiently high for combustion, while practically, no inconvenience found in firing furnaces so arranged.

Slip of the Paddle Wheel.—The circumference of the centre of effort the paddles is 107·3 feet. The mean slip was, therefore,

7·3×15·827×60=101894·226 ft.=sp. of cen. effort of paddles p. h.
3·13×6140 = 80618·200 ft.=speed of vessel per hour.

21276·026 ft.=slip per hour, or 20·88 per cent.

For the Journal of the Franklin Institute.

Propeller Steamers between Boston and Halifax.

The Boston merchants, after chaining their tri-mount City to the surınding States as well as the Canadas, by the aid of their seven magicent railroads, have concluded to extend the sphere of their mercantile terprise, by launching into a new element, in the establishment of a line propeller steamers, to ply between Boston and Halifax; and to that end, essrs. Clark & Jones have contracted for a propeller as the pioneer, of dimensions herein given.

The trade between Boston and Halifax has heretofore been carried on a line of sailing vessels, belonging to the same gentlemen, except ıat may have been done by the English Mail Steamers.

The manifest advantages of propellers over sailing vessels is so plain, m the fact, that the trips of the latter must necessarily be without reguity, while those of the former, under all ordinary circumstances, can be depended on, that the surprise is, that a line of this description has t been put in operation before this. Many passengers from Halifax, as

well as other parts of Nova Scotia, coming to Boston, have heretofore crossed to St. Johns, N. B., and then taken steamers to Boston; a great portion of this travel will undoubtedly come by this new line. A fair proportion of the travel also between the Canadas and Nova Scotia will also, doubtless, prefer the route to Boston by railroad, and thence by this line to Halifax. This accommodation of passenger traffic, and a continually increasing trade with the Provinces, furnish good ground for the belief, that the enterprise will prove successful. One trip a week is anticipated.

The following are the dimensions of the hull, engines, &c.:

HULL.

Length on deck,	171 feet.
" between perpendiculars,	168 "
Breadth of beam,	28 "
Depth of hold,	18 " 6 inches.
Tonnage,	700 tons.

Three-masted schooner rigged, with foresail and foretopsail. Hollow lines, with an exceeding fine entrance.

Builder—Mr. J. D. Curtis, of Medford, Massachusetts.

DIMENSIONS OF ENGINES, &c.

Two cylinders, inverted.	
Diameter of cylinders,	44 inches.
Length of stroke,	33 "
Diameter of air pumps,	
Length of stroke,	18 "
Slide Valves,	
Diameter of shaft in journals,	10 "
Diameter of propeller,	8 feet 4 "

Air pumps worked by beams from cross-head. S.

---

*Baillie's Volute Springs.**

The only springs shown in the Great Exhibition, which were lucky enough to gain a prize, were Baillie's volutes; and it is not perhaps too much to add, that their simplicity and excellence fully entitle them to this distinguishing honor. The material of which they are made is flat steel with parallel edges, but tapering in thickness from one end to the other. Such pieces of metal are wound spirally into a cone, so as to sustain pressure and deflexion in the direction of the breadth of the metal. In bringing the invention before the readers of this *Journal*, we have selected as illustrations two examples of the springs as applied to railway purposes.

Fig. 1 is a longitudinal section of a double-spring railway passenger carriage-buffer. The outer cylinder, A, bolted to the front buffer beam, has within it the two volutes, B C, set with their apices towards each other, upon a guide-spindle fastened to the cylinder bottom, this spindle having upon it a bearing disk to receive the pressure from the two springs, when forced towards each other. The short sliding cylinder, D, carrying the buffer disk on its outer end, is fitted to slide within the open end of the spring cylinder, A, and encircles one of the springs, B, a diaphragm being cast across the cylinder, D, to communicate the external pressure to the base of the spring, and to act as a further guide, by passing the

* From the London Practical Mechanic's Journal, December, 1851.

spring-guide spindle through its centre. It thus forms a most compact buffer, one or more volutes being enclosed in the cylinder according to the extent of range required. The springs may also be fitted up by simply stringing two or more springs on the rods beneath the carriage body, and as the volutes do not interfere with the timbers of the trussed framing, a more simple and rigid structure is attainable with a smaller amount of woodwork.

For engines and goods wagons a single spring only may be used, the most economical fitting being simply to fix them on the buffer-rod beyond the end framing, and if the springs need any protection, the timbers may be conveniently contrived with a hollow to receive them.

Fig. 1.—1-12th.

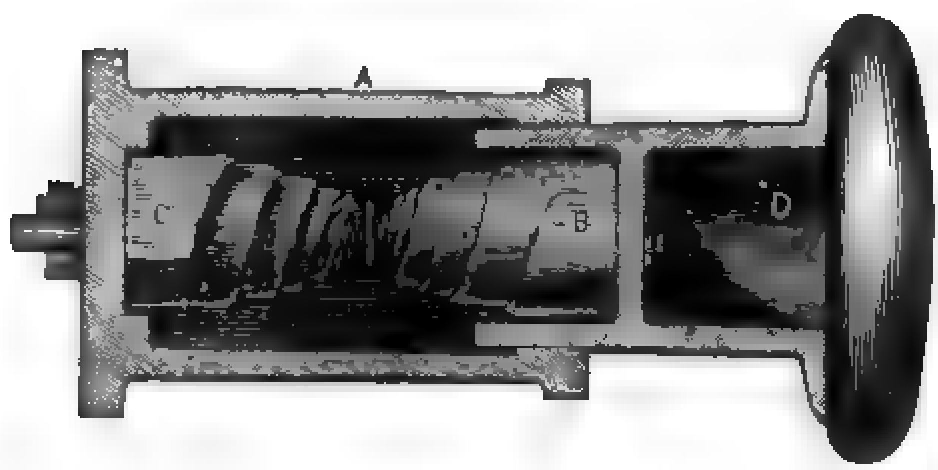


Fig. 2.—1-24th.

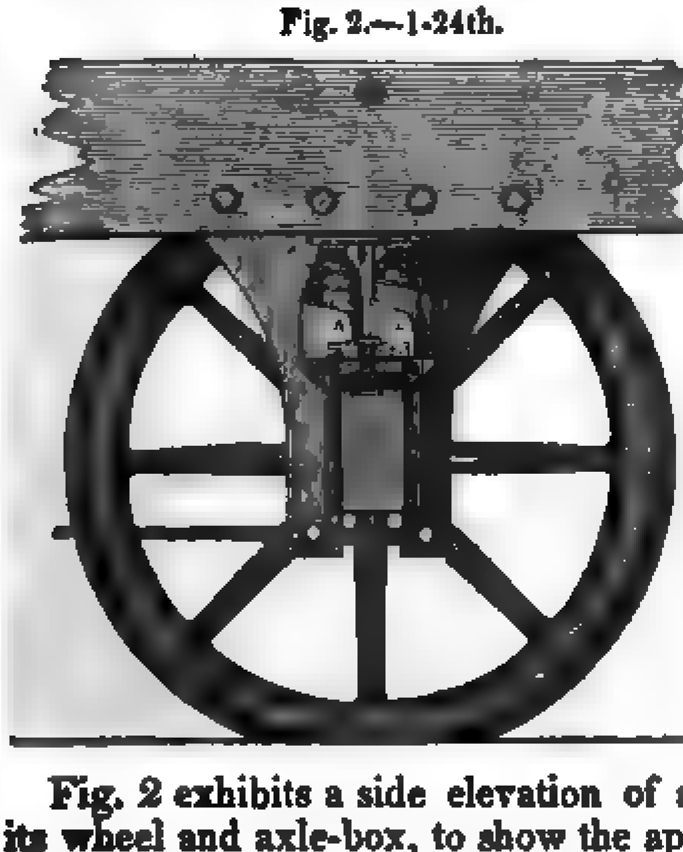


Fig. 3.—1-32d.

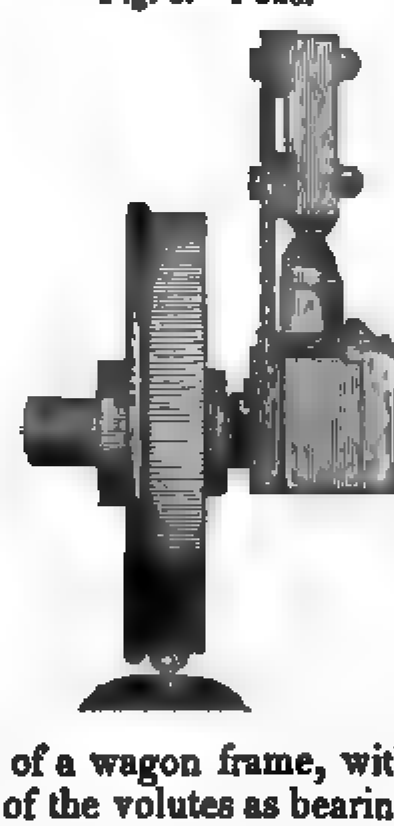


Fig. 2 exhibits a side elevation of a portion of a wagon frame, with its wheel and axle-box, to show the application of the volutes as bearing springs. Fig. 3 is an end elevation of the same, drawn to a slightly smaller scale. The top of the axle-box has a short cross-bar, which answers to receive the bases of a pair of springs, A, set one on each side the line of the axle's centre, on guide-spindles—the apices, of course, abutting against the lower side of the frame. One spring in the centre may be used instead of two, but the duplex arrangement is much more efficient.

As drawing springs, they are applied by passing through them a bolt with adjustable nuts, to convey the pressure to the apex of the volute. If placed at or near the centre of the carriage, they will act both ways, by using a short length of tube with a slot in the draw-bar. The latter can in this way lengthen itself, rendering great assistance to the engine in getting under way with a heavy train. It is claimed for this form of spring, that it is capable of sustaining equal loads with one-third the weight of steel necessary in the common spring. Although thus light, the peculiarity of action in applying the pressure edgewise to the coils, renders them remarkably free from liability to fracture, whilst, whatever amount of force is sustained by them, the coils are always brought up to a firm bearing at the end of their traverse.

Application of Organic Chemistry to Perfumery. From a Letter written by Dr. Hofmann *to* Prof. Liebig.*

The beautiful investigations of M. Cahours upon the oil of *Gualtheria procumbens*, which have made us acquainted with the nature of this compound, so much used in perfumery, appears not to have been lost sight of in the arts.

The arrangement of the oil of winter-green in the group of the compound ethers could not do otherwise than direct the attention of the manufacturers of perfumery to this extensive class of bodies, the number of which is still further daily increased by the active energy devoted to the field of organic chemistry. The remarkable fruity odor of many of these ethers had not been overlooked by chemists; but it was reserved for practical men to make the selection and ascertain the proportions in which certain of these compounds resembled in so great a degree the aroma of particular fruits, that we almost feel ourselves led to the idea, that these very compounds are the cause of the odor of the fruits in question, and that they would be found in them, if the processes were followed on a sufficiently large scale.

The artificial production of aromatic oils for commercial purposes has only been carried on for the last few years; but although the process of fabrication is so new, yet it appears to be already in the hands of several distillers, some of whom make tolerably large quantities. The jury were enabled to satisfy themselves of this, in their examination of the products belonging to this department in the Exhibition. We found in our surveys at the Exhibition, both in the English and in the foreign divisions, a copious selection of these chemical articles of perfumery, the applicability of which was moreover illustrated by the simultaneous exposition of the confectionary flavored with them.

Unfortunately, most of these oils were only sent in small quantities, so that the specimens which I was enabled to obtain, in few cases only allowed of accurate examination.

The compound most frequently exhibited was a liquid labelled "*pear oil*," which on examination was shown to be an alcoholic solution of pure *acetate of amylic oxide*. As I had not enough of the compound to allow of its sufficient purification for ultimate analysis, I decomposed it with

*From the Chemical Gazette, London, March 1, 1851.

potash, when free fusel oil separated, and the acetic acid was determined in the form of the silver salt. The acetate of silver gave per cent.

Theory.	Experiment.
64·68	64·55

The acetate of amylic oxide, when obtained by the ordinary process, (one part of sulphuric acid, one part of fusel oil, and two parts of acetate of potash,) evolved a remarkably fruity odor; but the agreeable odor of the Jargonelle pear was not distinct until it was diluted with 6 vols. of alcohol. On close inquiry of the exhibitors, I ascertained that tolerably large quantities of this oil (in one case 15–20 lbs. weekly) are manufactured. It is principally used for flavoring pear drops, which are much admired in England, and which consist almost entirely of barley sugar.

Next came the *apple oil.* As the examination shows, it is nothing more than valerianate of amylic oxide, and every one is at once reminded of the insupportable odor of rotten apples, which fills the laboratory, in making valerianic acid. When the crude distillate of this operation is treated with dilute alkali, the valerianic acid is separated, and an ether is obtained, the solution of which in about 5 or 6 vols. of alcohol possesses a most agreeable aroma of apples.

The essence in greatest quantity was the *pine apple oil,* which, as you are aware, is only butyrate of oxide of æthyle. This compound, also, like the two above, does not evolve the agreeable odor until diluted with a large amount of alcohol. Butyric ether, which in Germany is frequently added to the inferior kinds of rum, is principally used here for flavoring a kind of lemonade (pine apple ale). For this purpose it is however seldom prepared from pure butyric acid, but generally by merely saponifying the butter, and distilling the soap with concentrated surphuric acid and alcohol. The liquid thus obtained of course contains other ethers besides butyric ether, but it may be used in this state for flavoring. The specimen which I analyzed appeared however to be the pure ether prepared from butyric acid. When decomposed by potash, and converted into a silver salt, it yielded—

Experiment.	Theory.
55·33	53·38 per cent. of silver.

The so called *cognac oil* and *grape oil* were sent both by English, as also French and German exhibitors. They appear to be used pretty commonly for imparting the favorite cognac odor to low brandies. Unfortunately, the specimens exhibited were too small in quantity to allow of my instituting an accurate examination of these oils. The cognac oil especially was in very small quantity; on the addition of water to the whole of the sample, a few drops only separated, and these consisted of a mixture. The grape oil is also an amyle compound, dissolved in much alcohol; for when treated with concentrated sulphuric acid, the oil, freed from alcohol by washing with water, yielded sulphate of amylic oxide, which was identified by the analysis of the barytic salt. It yielded 45·82 per cent. of sulphate of baryta.

The crystallized amylo-sulphate of baryta with two equivs. of water, analyzed by Cahours, and again recently by Kekulé, contains 45·95 per cent. of sulphate of baryta. It is certainly remarkable, that we see here

a body, which on account of its insupportable odor is separated from brandy with the greatest care, again applied in an altered form to flavor this beverage.

I must also allude to the *artificial oil of bitter almonds.* When Mitscherlich, in 1834, discovered nitro-benzole, he little thought, after twenty years, to find this body in an industrial exhibition. He certainly, at that time, pointed out the remarkable resemblance which the odor of nitrobenzole had to that of oil of bitter almonds; but the only sources for obtaining benzole at that time, viz: the oil of compressed gas and the distillation of benzoic acid, were much too expensive, and put an end to the idea of substituting the use of nitro-benzole for oil of bitter almonds. However, as you recollect, by means of the well known aniline reaction, I showed with the utmost certainty the presence of benzole in the common light oils of coal tar, which had frequently been previously suspected; and in 1849, C. B. Mansfield showed, by a careful investigation, that benzole may be procured easily, and in large quantity, from oil of coal tar. In his memoir, which contains many valuable details upon the practical applications of benzole, the possibility that the fragrant nitrobenzole may be obtained in larger quantities is alluded to. As the Exhibition shows, this remark has not been lost sight of in the arts. Among the articles of French perfumery, with the title of *artificial oil of bitter almonds,* and the fanciful name of *essence of Mirbane,* there were several specimens of oils, which on accurate examination proved to consist of more or less pure nitro-benzole. I was not enabled to ascertain accurately the extent of this fabrication; but it appears to me by no means inconsiderable. Here, in London especially, tolerable quantities of this artificial oil of bitter almonds are prepared. The very simple apparatus used is that proposed by Mr. Mansfield. It consists of a large glass worm, the upper end of which branches into two tubes, which are provided with funnels. A stream of concentrated nitric acid flows slowly through one of these funnels, whilst the other is for the benzole (which for this purpose need not be absolutely pure.) At the point at which the tubes of the funnels are united, the two bodies come in contact; the chemical compound formed becomes sufficiently cooled in passing through the worm, and only requires to be washed with water, and finally with some weak solution of carbonate of soda, to be ready for use. Although the nitro-benzole closely resembles oil of bitter almonds in physical properties, it possesses however a somewhat different odor, readily recognised by a practised hand. However, it answers well for scenting soap, and would be extensively applicable for confectionary and for culinary purposes. For the latter purpose it has the special advantage over oil of bitter almonds, that it contains no prussic acid.

Besides these, several other similar products were exhibited, but most of them were of too compound a nature, and in too small a quantity, to allow of their composition being accurately determined. In the case of many of these essences, their resemblance to the aromas specified was very doubtful.

The application of organic chemistry to perfumery is still in its infancy; and we may expect that a careful survey of those ethers and etherial compounds with which we are at present acquainted, and those which

are daily being discovered, will lead to further results. The interesting caprylic ethers, which M. Bouis has lately discovered, are remarkable from their extremely aromatic odor, (thus the acetate of caprylic oxide possesses an odor as strong as it is agreeable,) and promise, if they can be obtained in larger quantities, to yield new materials for perfumery.—*Ann. der Chem. und Pharm., vol.* LXXXI, *p.* 87.

On the Expansion of some Solid Bodies by Heat. By HERMANN KOPP.*

The method of experiment adopted by Prof. Kopp in his laborious and valuable investigation is to ascertain the specific gravities of a body when immersed in fluids of various temperatures, and thence, by means of the known expansion of the fluid, to determine the cubic expansion of the body. A flask was taken furnished with a carefully ground glass stopper; and the first point to be ascertained was, "what weight of water, freed from air, and at different temperatures, was the flask able to contain?" For low temperatures, the flask and its contained water were placed in a large vessel filled with the same fluid, the temperature of which was shown by two thermometers immersed in it. When it was certain that the flask had assumed the temperature of the surrounding water, the stopper (which was preserved at the same temperature,) was set on, the flask dried, and then carefully weighed. For temperatures of 40° or 50° C., the flask was immersed in a large beaker filled with water, which again was immersed in a second larger beaker, also full of water; the latter was heated, and after some time the water surrounding the flask acquired a uniform temperature of the required height; the glass stopper, which up to this time had been preserved in water of the same temperature, was now set on, the flask removed, dried, and weighed as before. When the quantity of boiling water held by the flask was to be ascertained, the latter was properly fixed in the neck of a large bolt-head, in which a quantity of water was kept violently boiling. The flask was here surrounded by steam, and precautions were taken to prevent any inconvenient loss of heat by radiation or by contact with the surrounding air.

Having ascertained the amount of water embraced by the flask at numerous temperatures, a proceeding exactly similar was followed to ascertain the specific gravity of the substance. The flask with the substance alone was first weighed; the flask was then filled with water, the air completely expelled by boiling, and then the weight of the known quantity of solid substance, plus the weight of the water necessary to fill the flask at various temperatures, was ascertained.

Suppose the weight of the flask of water at the temperature t^0 to be W, the weight of the solid substance to be examined to be P, and the weight of the water and substance which together filled the flask at t^0 to be S, then we have

$$\frac{P}{W-(S-P)}=D_t,$$

where D_t expresses the specific gravity of the substance referred to water of the temperature t^0 as unit. Further, is $\frac{D_t}{V_t}=D_0=$ the specific gravity

* *From the Lond., Edinb., and Dublin Philosoph. Magazine*, April, 1852.

of the solid substance at t^0 referred to water at 0^0 as unit, where V_t expresses the volume which one volume of water at 0^0 assumes on being heated to t^0.

Supposing that for two temperatures t and t', the former of which is lower than the latter, the specific gravities D_0 and D_0' respectively be found, then is the cubic expansion of the body

$$=\frac{1}{t'-t}.\left(\frac{D_0}{D_0'}-1\right)$$

The expansion of water by heat was made the subject of special inquiry, and numerous substances were examined whose linear expansion had been determined by other methods and other men; the agreement between M. Kopp's results and those already determined furnishes a proof that the method pursued and precautions taken may be relied on.

We here transcribe a tabular statement of M. Kopp's results, premising that each is the mean of several experiments:—

Substance,	Formula.	Cubic expansion for 1°.	Determined by means of
Copper,	Cu	0·000051	Water.
Lead,	Pb	0·000089	"
Tin,	Sn	0·000069	"
Iron,	Fe	0·000037	Mercury.
Zinc,	Zn	0·000089	Water.
Cadmium,	Cd	0·000094	"
Bismuth,	Bi	0·000040	"
Antimony,	Sb	0·000033	"
Sulphur,	S	0·000183	"
Galena,	PbS	0·000068	"
Zinc blende,	ZnS	0·000036	"
Iron pyrites,	FeS^2	0·000034	"
Rutile,	TiO^2	0·000032	"
Oxide of tin,	SnO^2	0·000016	"
Oxide of iron,	Fe^2O^3	0·000040	"
Magnetic ore,	Fe^3O^4	0·000029	"
Fluor spar,	$CaFl$	0·000062	"
Arragonite,	CaO, CO^2	0·000065	"
Calcareous spar,	CaO, CO^2	0·000018	"
Bitter spar,	CaO, CO^2+MgO, CO^2	0·000035	"
Carbonate of iron,	$Fe\ (Mn, Mg)\ O, CO^2$	0·000035	"
Heavy spar,	BaO, SO^3	0·000058	"
Cœlestine,	SrO, SO^3	0·000061	"
Quartz,	SiO^3	0·000042	"
		0·000039	Mercury.
Orthoklas,	$KO, SiO^3+Al^2O^3, 3SiO^3$	0·000026	Water.
		0·000017	Mercury.
Glass, soft soda glass,		0·000026	Water.
Glass, soft soda glass, another kind,		0·000024	Mercury.
Glass, hard potash glass,		0·000021	Mercury.

Taking every possibility of error into account, M. Kopp considers that we may infer with certainty from the preceding numbers, that the expansion of solid substances is by no means determined by their chemical nature. The difference between the coefficients of expansion for arragonite and calcareous spar is so great as to destroy all hope of establishing any relation of the kind. Neither does the expansion appear to depend altogether on the arrangement of the atoms; for although bitter

: and carbonate of iron agree, and heavy spar differs but little from estine, in the cases of carbonate of iron and carbonate of lime, and of le and oxide of tin, no such agreement exists. The table further ws that there are many non-metallic substances which expand as much er the action of heat as the metals themselves.—*Ann. der Chem. und rm., Vol.* LXXXI, *No.* 1, *p.* 1–67.

---

cription of a New Method of Preparing Negative Photographic Paper. By M. GUSTAVE LEGRAY.*

ersons who are engaged in the process of photography on paper, are l aware of the difficulty of obtaining paper of a good quality, and suit- adapted to receive uniformly the requisite chemical preparations. fter having made a great number of trials, I have succeeded in meet- this difficulty by the use of a size adapted, I may say, to any kind of er.

'aper thus prepared so much facilitates the photographic process, and s to assure a satisfactory result, that I make no doubt it will be gene- y adopted.

'he substance used for this size is virgin wax, which is kept at a tem- ature of 100° centigrade, in a large flat vessel, and the paper is im- sed therein until completely saturated with the wax. The sheet of er is then withdrawn, and laid between several pieces of blotting er, over which a moderately heated iron is passed, which causes the ting paper to absorb the superfluous wax. If the paper is properly pared, there will be no gloss whatever on its surface, and it will be ectly transparent.

'he waxed paper is then immersed in a warm solution, composed as ows:

1000	parts of	rice water.
40	"	sugar of milk.
15	"	iodide of potassium.
0·80	"	cyanide of potassium.
0·50	"	fluoride of potassium.

he sheet of paper should be laid in this solution for half an hour, and ay then be withdrawn, and hung up to dry.

he paper is then immersed in a clear solution of aceto-nitrate of silver, h is thus formed:

300	parts	distilled water.
20	"	azotate of silver.
24	"	crystallizable acetic acid.
5	"	animal charcoal.

he animal charcoal serves to render the paper more susceptible to ive impressions, and decolorizes the solutions when they have been iously used. The paper should remain three minutes in this solution, in order to insure contact with the liquid, the two sides of the sheet ld be rubbed over with a brush. The paper is then washed several s with distilled water, and well dried between pieces of blotting r. Paper thus prepared may be taken immediately into the dark aber, and it is not necessary to subject the image to the action of

* *From the London Mechanics' Magazine, for January*, 1852.

gallic acid on its removal from the camera; this may be deferred till the evening, or even the next day, or the day following.

The paper may be kept in a dark place for more than a fortnight without undergoing any alteration, and in this respect offers greater advantages than any of the photographic papers hitherto known. The solution of gallic acid is composed of 1 part of gallic acid, half part (0·5) of azotate of silver, and 200 parts of distilled water. The image is fixed as usual by hydro-sulphite of soda.

I have submitted to the Academy a series of specimens obtained by this process. It is so easily put in practice that, during a mission which I have just fulfilled for the Commission of Historical Monuments, I have often taken twenty-five or thirty photographs a day.

Improvements in the Manufacture of Glass, Porcelain, Earthenware, China, and Artificial Stone.—Patented October 2, 1851, by W. Hodge, of Cornwall.*

For the purposes above specified, hornstone porphyry is adopted by the patentee as a material which has not been hitherto used.

Claim.—The application of this material, called elvan, to the manufacture of glass, porcelain, earthenware, china, and artificial stone.

For the manufacture of glass, it is powdered, washed, and mixed with other pulverized materials in the melting pot.

For the manufacture of porcelain, &c., it may be used alone or in combination with other materials. It is powdered, brought to a plastic state, moulded, dried, and fired in the usual way. It can likewise be employed for making glazes.

For the manufacture of artificial stone, it is used alone or combined with broken stone, and reduced to a plastic condition, moulded into blocks, dried, and fired in the usual manner.

Experimental Researches in Electricity. Twenty-ninth Series. By Michael Faraday, Esq., D. C. L., F. R. S., &c.†

In the present series of researches the author endeavors in the first place to establish the principles he announced in the last, with regard to the definite character of the lines of magnetic force, by results obtained experimentally with the magnetic force of the earth. For this purpose he reverts to the thick wire galvanometer before described, and points out the precautions respecting the cleanliness of the coils, the thickness and shortness of the conductors, the perfect contacts, effected either by soldering or cups of mercury; and marks the value of double observations, i. e. observations afforded on both sides of zero. The nature of the impulse on the needles is pointed out; being not that of a constant current for a limited or unlimited time, but of a given amount of electricity exerted, either regularly or irregularly, within a short period; and it is shown

* From the London Civil Engineer and Architect's Journal, May, 1852.
† From the London, Edinburgh, and Dublin Philosophical Magazine, April, 1852.

experimentally that such impulses produce equal results of deflexion, and also that when two or more such impulses are given within a limited time, the whole arc of swing is nearly proportional to their number; so that the amount of deflexion, *within certain limits*, indicates directly, nearly the proportion of electricity which has passed as a current through the instrument.

If a wire be formed into a square of 12 inches in the side, and then fixed on an axis passing across the middle parallel to two of its sides, and if, when that axis is perpendicular to the line of dip, the whole is rotated, then two of the sides of the rectangle will, in one revolution, twice intersect the lines of force of the earth passing across or through one square foot of area. The currents then tending to move in the upper and lower parts of the rectangle, will conjoin to urge one current through the wire; and if this wire be cut at one place close to the axis, and be there connected with a commutator of simple construction, which is described in the paper, the currents round the rectangle may be conveyed away to the galvanometer, and there measured. Such a rectangle, constructed of copper wire one-twentieth of an inch in thickness, gave a certain arc of swing for one revolution. If five or ten revolutions were made, within the time of vibrating of the needle, nearly five or ten times this amount of deflexion was produced; the mean result, in the present case, was 2°·624 per revolution. When the same length of the same wire was arranged in oblong or oblate rectangles, so as to diminish the inclosed area in different directions as regarded the axis of revolution, still the deflexion was in every case proportional to the areas included; showing that the effect produced was proportional to the number of lines of force intersected by the moving wire. The same result was obtained when two squares having areas in the proportion of 1 to 9, were employed.

When squares of the same area were formed of copper wire of different thicknesses, then the effects of obstruction in the conducting part of the system were brought out and measured. Thus, with wires which were 0·05, 0·1, and 0·2 of an inch in diameter, and therefore in mass as 1, 4, and 16, the deflexions were 1, 2·78, and 3·45; a result almost identical with that obtained for the same wires by the use of loops and a local magnet in the former researches. When two equal rectangles were compared, one containing a single circuit of 4 feet of wire 0·1 in thickness, and the other four circuits of 16 feet of wire 0·05 in thickness, then the first was found to evolve the largest quantity of electricity; but the second, electricity of the highest tension, by the same amount of motion: the accordance of these results with the principles advanced is pointed out. The author then refers to the use of wire rings of one or many convolutions, and indicates cases in which they may supply valuable means of experimental inquiry.

The relative amount and disposition of the forces of a magnet when it is alone, or associated with other magnets, forms the next point in the present paper; and a distinction is first taken between ordinary magnets, which are influenced much by other magnets, so that the amount of their external force varies greatly, and those which are very hard, where this influence is reduced to little or nothing. The power of a given magnet

was measured according to the method described in the last series, by a loop once passed over its pole. A given hard magnet placed in an invariable position, being thus estimated, was found to have a force equivalent to 16°·3 of deflexion. Another magnet, having a power of 25°·74, was then placed close to the first in different positions, with like or unlike poles near together, so as to tend sometimes to exalt its power and at other times to depress it; and the results observed. In the extremest favorable case, namely, when the two were conjoined as a horse-shoe magnet, the force of the first magnet was only raised 2°·45, which fell directly the dominant magnet wes removed; in the corresponding adverse case the depression was only 1°. A very hard magnet, made by Dr. Scoresby, of 6°·88 power, when under the influence of another of double its power, was not sensibly affected either way. When under the influence of one of six times its force, it could be affected to the extent of nearly 1°. Ordinary magnets could be affected to the extent of one-half of their power or more; and indeed in extreme cases can be altogether overruled and inverted.

From these results the author concludes, that, with perfect unchangeable magnets, the lines of force (as before defined) of different magnets in favorable positions, coalesce; that there is no increase of the total force by this coalescence; the sections between the associated poles giving the same sum of power as the sections of the lines of either magnet alone; that as the external amount of force of the magnet is not varied, neither is the internal amount at all changed; that the increase of power upon a magnetic needle, or a piece of soft iron, placed between two opposite favorable poles, is caused by concentration of the lines which before were diffused, and not by the addition of the power represented by the lines of force of one pole to that of the lines of force of the other. There is no more power represented by *all* the lines of force than before, and a line of force is not in itself more powerful because it coalesces with a line of force of another magnet. In this and in other respects, the analogy of the magnet with the voltaic pile is perfect.

The paper concludes with some practical remarks upon the delineation of the forms of the lines of force by iron filings, and by a description of the inflexion of the lines by hemispheres of hot and cold nickel; which the author considers as the corresponding case to the action of warm and cold oxygen in the atmosphere, as applied by him in the explication of some of the phenomena of atmospheric magnetism, and especially of the annual and daily variation.

Repair of a Vessel's Bottom while Afloat. By W. Moody, Foreman of Shipwrights.*

The *Geyser*, steam sloop, has been taken into dock, and her bottom examined, as it was greatly injured by the vessel striking on the rocks at Ile Grand, about 50 miles from Janeiro. Fifty-four feet in length, and several planks in breadth, had been stove in by the accident, but her commander, by adopting a plan suggested by Mr. Moody, foreman of

* From the London Civil Engineer and Architect's Journal, January, 1852.

shipwrights at Woolwich Dockward, the *Geyser* was repaired while afloat, and brought home safe to this country, although the injuries she sustained were within a short distance of the keel.

The following, which has been issued by the Admiralty, explains the mode of repairing the damage the *Geyser* sustained on a shore where she must otherwise have been left to her fate, as the tides only rise a few feet, and the great weight of her engines would have prevented her being drawn up on shore.

"In obedience to directions to report the manner in which I proceeded to replace a defective sheet of copper on the bow of her Majesty's ship *Hyacinth*, the same being five feet below the light water-line, I beg to state, that on considering what means could be adopted for so doing, short of heaving the vessel out, it occurred to me that the principle of coffer-dam might be applied to it. I accordingly caused a water-tight case of three sides and a bottom to be made, ascertained the curve on the bow on each side of this defective part, and cut the mouth or open side of the case to fit it; and having lined or dressed the curved edges with felt, saturated with tallow, and attached ballast to the bottom, the case was suspended by a tackle to the rough tree rail, and lowered until the top was within a few inches of the surface, opposite the defective part, over which it was hauled by means of two hawsers, one placed vertically from the rough tree rail under the keel to the opposite side, the other horizontally from the quarter round to the stern to the opposite side, and both set taut with tackles. By these means the case was made to fit close to the bottom, where it was further secured by a shore, reaching from the side of the ship to its outer edge, to prevent its rising. The suction hose of a fire engine was then placed in the case, and the water contained in it pumped out. When empty, two shipwrights descended, and removed the defective copper, replacing it with a new sheet. The operation from the time of suspending the case until completed, did not occupy more than twenty minutes.

"This principle could be applied to the repairs of many defects under water, such as the wing cocks of ships, or the pipes in the bottom of steam vessels."

On the Compounds of Cotton with the Alkalies. By Dr. J. H. Gladstone.*

The author first described the process of Mr. Mercer, by which the beautiful fabrics made known to the public through the Great Exhibition are produced. When cotton, or an article made of that material, is immersed in strong caustic soda in the cold, a certain combination is effected—which is again destroyed by pure water; but the "Mercerized" cotton thus produced is permanently contracted, and rendered more susceptible of dyes. This was illustrated by a number of specimens, much shrunk, so that they assumed an appearance of extraordinary fineness, others puckered in patterns by partial Mercerization, and others again printed with colors which surpassed in depth and brilliancy the colors

* From the London Atheneum, February, 1852.

produced by the same means on the calico in its original state. Dr. Gladstone proceeded to detail experiments by which he had succeeded in obtaining the compound of cotton and soda free from adhering alkali, through the agency of strong, sometimes absolute, alcohol. He found that the proportion of soda which combined with the lignine varied with the strength of the solution employed, but under no circumstances exceeded one atom. There was a varying amount of combined water. Some properties of this compound were discussed, and the author then proceeded to state his conviction, that there was no sufficient ground for viewing the "Mercerized" cotton as chemically different from the original lignine. It is identical in composition, and the change of properties may be accounted for by the change in its physical condition. When viewed under the microscope, the fibres in their ordinary condition appear as flattened twisted ribands; but the moment they are touched by the alkaline ley, they untwist themselves, contract in length, and swell out, assuming a rounded solid form; and this circular appearance they retain after the soda is removed by water. This not only explains the shrinking, but the cause of a larger quantity of dye being absorbed as the substance of the fibre itself is porous. Potash has a similar action to that of soda.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, June 17, 1852.

Edmund Draper, Esq., President, *Pro. Tem.*
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations were received from The Royal Astronomical Society, London; Henry Gassett, Esq., Boston, Massachusetts, and Messrs. P. A. Brown, Dr. L. Turnbull, Percival Roberts, Geo. M. Conarroe, and Dr. Charles M. Wetherill, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of May.

The Board of Managers and Standing Committees reported their minutes.

New candidate for membership in the Institute (1) was proposed, and the candidates (6) proposed at the last meeting were duly elected.

Mr. Geo. W. Smith reminded the meeting that on February 20, 1851, he had presented a list of the number of miles of railroads at that time completed in the United States, and an estimate of the number of miles that would be completed during the present year. Nearly two years having elapsed since the presentation of that estimate, he now had it in his power, from the reception of information from the whole of the United States, to test the accuracy of the predictions. The amount completed and to be completed the present year, inclusive, may be stated at 13,200 miles, including therein every description of railway, either public or *private*, an amount somewhat exceeding his former estimate, and derived *mainly* from the construction of lines not at that time in progress.

le then proceeded to give an estimate from the information that he collected of the progress of these works during the next three years, ling at the termination of 1855; admitting, however, that the same acacy was not as attainable as in the former estimate, inasmuch as that period would be greater, and many contingencies which might affect result could not be made the subject of calculation; the amount, wever, he estimated at 18,900 miles at the minimum, and might attain the maximum 19,700 miles, and even reach 20,000 miles if the bills w before Congress, in aid of Iowa and Missouri, should become law, l provided no commercial convulsion should create a stringency in the oney market.

He then described the vast army of laborers on these works, and the rious establishments directly or indirectly connected with them, as one the great causes of the rise in the price of food, the others being emiition to California, the unprecedented immigration to this country from great swarming hive of Europe, and the unprecedented increase of our an population in a great measure attributable to this immigration, and activity of commerce consequent thereon, and the result moreover in eat degree of these very railways, plank roads, canals, and steam navion. The high price of provisions was thus enhanced on the one hand, on the other prevented rising still higher by one and the same set of ses, which are likely still to continue for some time in operation. The ight of the last year and the unusual cold of the present, could but ially account for this rise.

n speaking of the density of population already attained in some parts he United States, Mr. Smith referred to a map which he had concted, which presented a curious illustration of this density. He traced boundary of an area as large as the kingdom of Great Britain, as fols: commencing on the Atlantic at the mouth of the St. Croix river, nding it to the head; from this point a line was drawn to the Saco, re it debouches from the White Mountains in New Hampshire, thence Sandy Hill on the Hudson, in New York; thence to Oswego on Lake tario, including all south of it in New York, and all of New Jersey, nsylvania, and Maryland, north of the Blue Mountains; along this untain to the Potomac in Maryland, thence by the latter river to Washton, D. C., thence by a straight line to New Haven on Long Island und, and thence by the sea to the place of beginning in Maine. The luded area will be 84,000 square miles, a close approximation to the ngdom aforesaid, and the population of this area at the present moment, luding the usual increase since the last census, is 8,180,000 in round mbers, an amount equal to that of Great Britain at the accession of orge III, and about one-third of that at the present day. The present habitants of the American area within the boundaries just mentioned, is ice *as great* as the *average* population to the square mile in Europe, and stly greater than the population of eastern or northern Europe, although uch less, of course, in comparison, than the British, French, German, strian, and Italian countries, &c.

A line drawn from Massachusetts Bay to the Potomac, almost in a aight line, passes through more numerous and more populous cities an can be found on a similar line of about 400 miles in extent, drawn

on any part of the globe, with the exception of China; London must also be excepted. The population of New York, with its suburbs in Long Island, New Jersey, &c., included in a circle of twelve miles radius round the City Hall, (as the metropolis of London is in a circle of twelve miles round St. Paul's,) is at the present moment, (1852,) 860,000 people, and at the termination of 1855, which will be the period when the 20,000 miles of railway mentioned in his address to the meeting this evening, would be completed, namely, in a little more than 3½ years from the present time, New York will contain more than one million.

Mr. S. alluded to the probable results of the enormous increase of the town population of the United States on the character and institutions of the people.

The Lenticular Stereoscope, the contrivance of Sir David Brewster, with a number of binocular daguerreotype portraits and representations of statues, and still life talbotypes and diagrams, were presented to the meeting by Mr. Smith, and the phenomena of vision which they illustrated, briefly explained. Mr. Smith stated that it was scarcely necessary to remind the members of a fact with which they were already well acquainted, namely, that soon after the first publication of the Stereoscope of Dr. Wheatstone, many years ago, he had at a public meeting of the Institute, from the place where he was now standing, and before some of the audience whom he was now addressing, proposed the execution of these very binocular daguerreotypes, and subsequently, of talbotypes, and had from time to time brought the subject before them, long prior to the publication of this interesting illusion, which has been revived, and doubtless reinvented by Sir D. Brewster. Mr. S. further stated that he had for many years been endeavoring to induce some of the daguerreotypists of this City to make such portraits, and an amateur had, at his request, a number of years ago succeeded in obtaining them. The stereoscope of Sir David Brewster is certainly superior to the simple contrivance claimed by Mr. Wheatstone, whether correctly or not, he would not detain the meeting by inquiring; dissimilarities of pictures on the retina of the human eye, when the optical axes converge, enabling us to judge of the form and solidity of objects, having been most strangely claimed by Mr. Wheatstone as a discovery of his. Mr. S. proceeded to show the invalidity of such claim, by an investigation of the history of binocular vision by various writers a half a century since, and went back to the times of Leonardo Da Vinci, and even to the times of Galen, 2000 years ago, to show that this phenomenon, so perseveringly claimed by Mr. W. as a new discovery, had been observed and understood even before "the time whereof the memory of man runneth not to the contrary." A phrase has long been in use among painters, namely, when a picture wants apparent relief, it is spoken of as a picture painted by a one-eyed man. Mr. S. then briefly drew the attention of the meeting to a number of methods by which different varieties of stereoscopes might be made, and that doubtless many others could readily be devised by such as were familiar with the elementary principles of optics.

Messrs. M'Clees & Germon, to whose courtesy the meeting was indebted for the beautiful binocular pictures before them, were, he believed, the first artists in Philadelphia who had prepared them for sale.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

AUGUST, 1852.

CIVIL ENGINEERING.

On Metallic Constructions. By W. FAIRBAIRN, C. E., F. R. S.*

[Paper read at the Mechanics' Institution, Manchester.]

Continued from page 5.

The Effect of Shot on Iron Vessels.—Although at first sight alarming, they are, on more mature consideration, such as might be reasonably expected. A number of experiments were undertaken some years since at the arsenal, Woolwich, to determine the effect of shot upon the hull of an iron vessel, and also with the view of providing means for stopping the passage of water through a shot-hole near or below the water-line. The gun used in the experiment was a 32-pounder, at the distance of 30 yards from the targets, and was loaded with the full charge of 10 lbs. of powder, and a charge of 2 lbs. to produce the effect of distance, or a long shot. At these experiments I was present, and the results—some of which I may venture to mention—were exceedingly curious and interesting. The initial velocity of the ball, 6 inches diameter, with a full charge of 10 lbs. of powder, is about 1800 feet per second, and with 2 lbs. of powder about 1000 feet. In these experiments there were five or six targets, about 6 feet square, composed of different thicknesses of plates, and variously arranged so as to represent in effect as well as appearance a

* From the London Civil Engineer and Architect's Journal, May, 1852.

portion of the side of an iron ship. The engravings (fig. 1) represent a side view and section of the plates and fastenings of the targets, and (fig. 2) the effect produced by the shot as it passed through the plates, and in three or four experiments through a lining of india rubber and cork dust, which was specially introduced to absorb or receive the splinters.

Fig. 1.

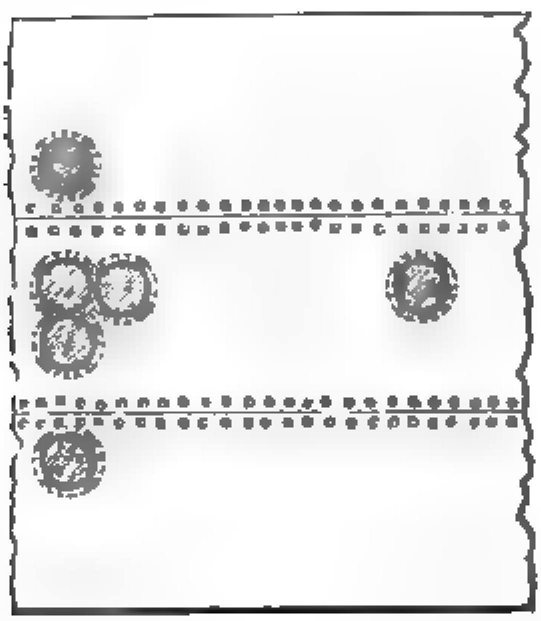
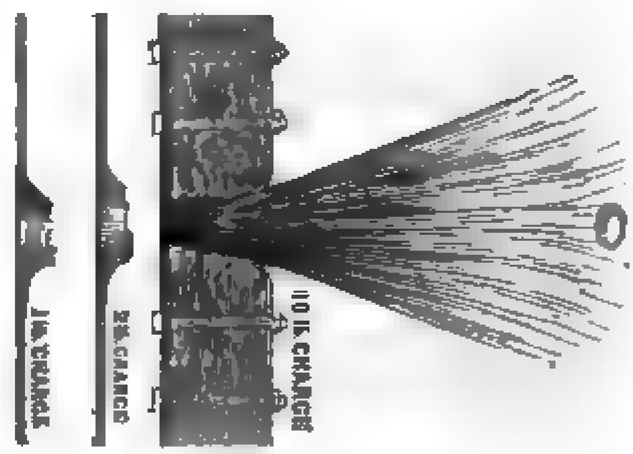


Fig. 2.



Whilst laying before you such information as I possess on the subject of iron ship-building, it is not my intention to trench upon the province of the marine architect as respects the lines, and other detail required in construction. This field is already occupied by men of superior talent, and the one that lays more immediately open before me is that which refers to the proportion of the parts, the distribution of the material, and the equalization of the powers of resistance to strain in all parts of the structure. These are considerations which, to a greater or less degree, affect almost every description of mechanical construction. If we study the laws of nature, we shall find in the endless varieties of construction in the animal and vegetable kingdoms no waste of material; that every animal and every plant is adapted to its purpose; its organization is perfect; every joint, muscle, and fibre is suited to the work it has to perform, and the utmost harmony, economy of material, and due proportion of the parts are the prominent features of the great teacher of all arts—Nature. With such examples before us, with such a wide and wonderful range of objects, why should we blunder and hesitate when we should analyze and investigate? There is no mechanism so intricate but what we find its compeer in nature, where we may find a rule for our guidance. We have, therefore, only to study the great Architect of the universe, and we need never be at a loss for examples, and, above all, close approximations to the laws which govern all constructions. As our present object is, however, to inquire into the laws which guide the experienced ship-builder in the prosecution of his art, it will be proper, in the first instance, to ascertain the nature and strength of the material he may choose to employ, in order to show the way it should be disposed to produce at a minimum cost the greatest possible effect. For these objects, I am fortunate in having before me a long series of experiments which I made for the same object more than ten years ago. They have elicited a great many facts,

of which the following is a short abstract, and which I trust may be equally beneficial in this as they have been in other constructions.

Resistance of Wrought Iron Plates to a Tensile Strain.—In these experiments, which were made on five different sorts of iron, the tensile strengths in tons per square inch are as follows:

Description of Iron.	In direction of fibre.	Across the fibre.
Yorkshire plates,	25·770	27·490
Yorkshire "	22·760	26·037
Derbyshire "	21·680	18·650
Shropshire "	22·826	20·000
Staffordshire,	19·563	21·010
Mean,	22·519	23·037

Or, as 22·5 : 23, equal to about $\frac{1}{43}$ in favor of those torn across the fibre. In following up the same investigation on timber, I found, according to Professor Barlow, of Woolwich, that the cohesive strength of different kinds of hard wood were—

Box,	20,000 lbs.	Beech,	11,500 lbs.
Ash,	17,000 "	Oak,	10,000 "
Teak,	15,000 "	Pear,	9,800 "
Fir,	12,000 "	Mahogany,	8,000 "

Assuming Mr. Barlow to be correct, and taking the main strength of iron plate, as given in the experiments, at 49,656 pounds to the square inch, or say 50,000 pounds, we have this comparison in pounds between wood and iron:

	Timber.		Iron.	Ratio.
Ash,	17,000	:	50,000	or as 1 : 2·94
Teak,	15,000	:	50,000	or as 1 : 3·33
Fir,	12,000	:	50,000	or as 1 : 4·16
Beech,	11,500	:	50,000	or as 1 : 4·34
Oak,	10,000	:	50,000	or as 1 : 5·00

Hence it appears that malleable iron plates are five times stronger than oak; or, in other words, their powers of resistance to a force applied to tear them asunder is as 5 to 1, making an iron plate ½-inch thick equal to an oak plank 2½ inches thick. In marine constructions, where the material is iron, our knowledge of its resisting powers would be incomplete, if we did not consider it in its union and all its bearings as regards its application to ship-building. Unlike timber, which has to be caulked between the joints, with a tendency to force them open, the iron ship is a solid mass of plates, which, if well riveted, will resist forces—such as the action of the seas—that no timber-built ship, however strong, would be able to withstand. The iron-built ship, when constructed with butt-joints, with interior covering plates, and smooth exterior surface, is superior as regards strength, buoyancy, and lightness, to any other vessel, of whatever material it may be constructed. In all these combinations it is, however, a desideratum to have the parts, the joinings, and the connexions as near as possible of equal strengths. This in practice cannot always be accomplished; but with due regard to a correct system of riveting and careful formation of the joints, a near approximation to uniform strength may be obtained. As a practical guide to these objects, I shall append a short summary of the experiment indicating the relative strengths of *different forms of* riveting, and in what they differ from the

strength of the plates, taking the whole as one continuous mass without joints. The results obtained from forty-seven experiments on double and single riveting are here recorded, the first column showing the breaking weight of the plates, the second the strength of single riveted joints, and the third that of double riveted joints, both of equal section to the plates, taken through the line of the rivets:

	lbs. per sq. inch.	lbs. per sq. inch.	lbs. per sq. inch.
	57,724	45,743	52,352
	61,579	36,606	48,821
	58,322	43,141	58,286
	50,983	43,515	54,594
	51,130	40,249	53,879
	49,281	44,715	53,879
	43,805	37,161	—
	47,062	—	—
Mean,	52,486	41,590	53,635

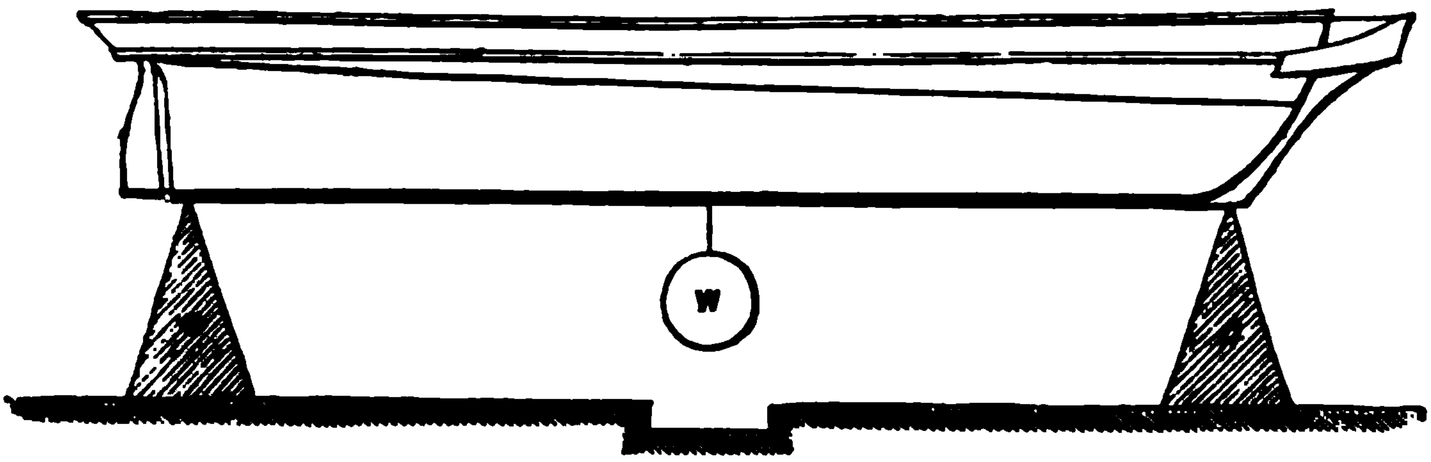
The relative strength will therefore be—for the plate, 1000; double riveted joint, 1021; single riveted joint, 791; which shows that the single riveted joints have lost one-fifth of the actual strength of the plates, whilst the double riveted joints have retained their resisting powers unimpaired. These are convincing proofs of the superior value of the double riveted joints; and in all cases where strength is required, this description of joint should never be omitted. In a previous analysis, the strengths were as 1000 : 933 and 731; but taking the mean, we have 1000 : 977 and 761 for the double and single riveted joints respectively. From these we must, however, deduct 30 per cent. for the loss of metal actually punched out for the reception of the rivets; and the absolute strength of the plates will then be to that of the riveted joints as the numbers 100, 68, and 46. In some cases, where the rivets are wider apart, the loss sustained is not so great; but in iron ships, boilers, and other vessels which require to be water-tight, and where the rivets are close to each other, the edges of the plates are weakened to that extent. Taking, however, into consideration the circumstances under which the results were obtained, as only two or three rivets came within the reach of experiment, and taking into account the additional strength which might be obtained by an increased number of rivets in combination, and the adhesion of the two surfaces of the plates in contact, we may reasonably assume the following proportions, which, after making every allowance, may be fairly considered as the relative value of wrought iron plates and their riveted joints. Taking the strength of plates at 100, we have for the double riveted joint 70, and for the single riveted joint 56; which proportions may safely be taken as the standard value of joints, such as are used in vessels required to be steam or water-tight, and exposed to a pressure varying from 10 lbs. to 100 lbs. on the square inch.

Having thus established correct data as respects the strength of materials, either singly or in combination, we shall have less difficulty in their application to the construction of vessels exposed to severe strains, such as boilers, bridges, or an iron ship; and notwithstanding the boasted declaration, that the "wooden walls of Old England" are our surest defences, we shall not, in my opinion, seriously injure, but greatly benefit our position by pinning our faith to the "iron walls of the sea-girt isle."

This, I am satisfied, will be the case if we persevere in the use of a material which must eventually supersede every other in the construction of vessels calculated to maintain the ascendency of the British marine.

Iron Ship-Building.—In the construction of iron ships three important considerations present themselves. First, strength and form; second, security; lastly, durability. To the first of these considerations, it will be necessary to ascertain for what purpose the vessel is to be used. Let us assume it to be one of the Atlantic, or other great ocean steamers, and we have a model both in form and tonnage, that would become equally formidable as a war steamer, or useful and commodious as a packet calculated to shorten the distance between the extreme points of a lengthened voyage. We must consider this important part of the question in all those varied forms and conditions to which vessels are subjected under strain, whether arising from a tempestuous sea, or from being stranded on a shore, under circumstances where they are not only seriously damaged, but where wooden vessels frequently go to pieces, and are entirely lost. In the former case, that of a tempest, such as a tornado under the tropics, where ships are not unfrequently much strained, we have in the iron ship, if properly constructed, greatly increased security; and provided we take the vessel in its best construction, and regard it simply as a huge hollow beam or girder, we shall then be able to apply with approximate truth the simple formula used in computing the strengths of the Britannia, and Conway, and other tubular bridges. Let us, for example, suppose a vessel of similar dimensions to the *Great Western*, (the first steamer that

Fig. 3.



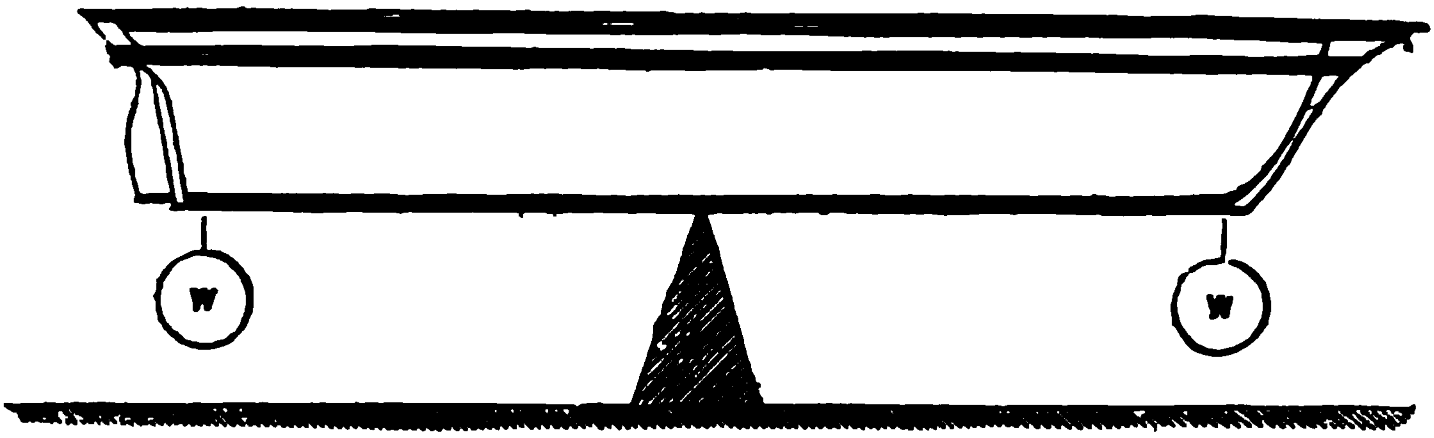


Fig. 4.

successfully crossed the Atlantic,) 212 feet long between perpendiculars, feet beam, and 23 feet from the surface of the main deck to the bottom the sheathing attached to the keel. Now, assuming a vessel of this magnitude, with its machinery and cargo, to weigh 3000 tons, including own weight, and supposing, in the first instance, that she is suspended on two points, the bow and stern, at a distance of 210 feet, as shown fig. 3, *we should have to* calculate from some formula yet to be ascer-

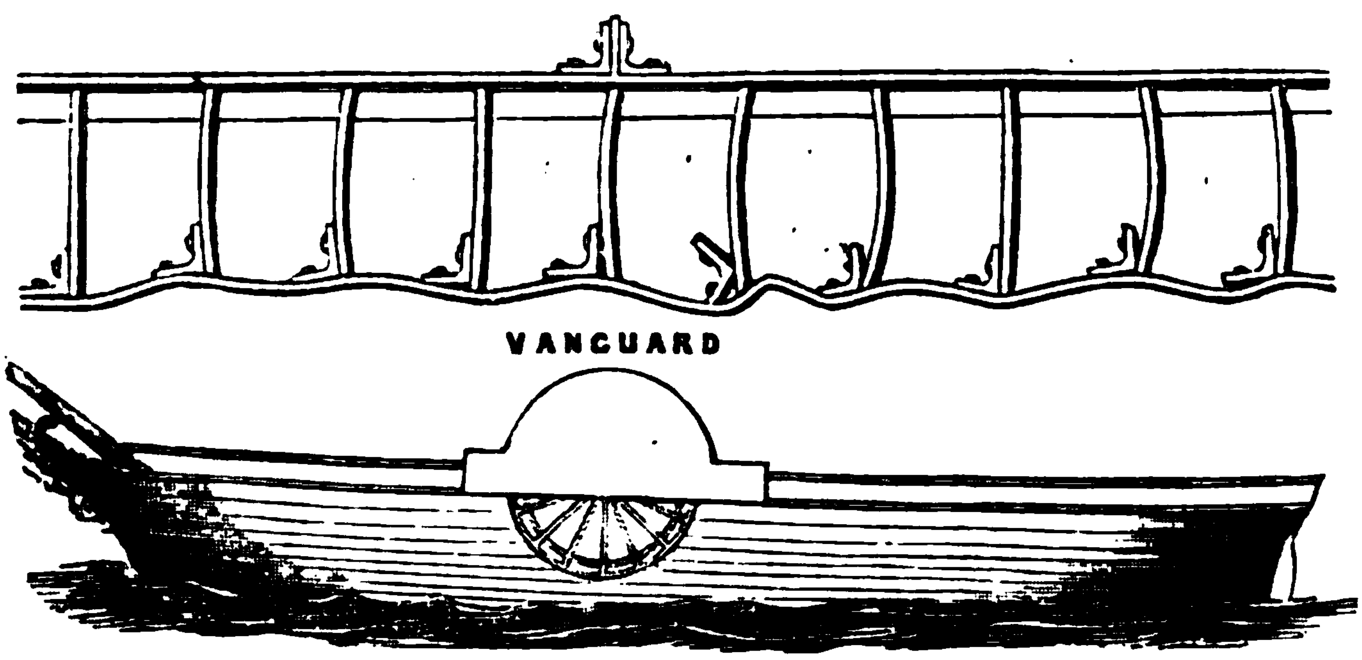
tained by experiment the correct sectional area of the plates, to prevent the tearing asunder of the bottom, and the quantity of material necessary to resist the crushing force along the line of the upper deck. These data have yet to be determined; but the iron ship-builder cannot be far wrong if he assumes the breaking weight in the middle to be equal to two-thirds of the united weight of ship and cargo. This, in the case before us, would give an ultimate power of resistance of 2000 tons in the middle, or 4000 tons equally distributed along the ship with her keel downwards. Let us now reverse the strains, and bring the vessel into a totally different position, having the same weight of cargo on board, and supported by a wave upon a single point in the middle, as shown in fig. 4. In this position, we find the strain reversed, and in place of the lower part of the hull of the ship being in a state of tension, the whole of the parts above the neutral axis are subjected to that strain; and that tension, as well as the compressive strain below, will be found to vary in degree as the ratio of the distances from the centre. In this supposed position, if we calculate the strengths—as I have been in the habit of doing, when the vessel is placed in trying circumstances, whether contending with the rolling seas of a hurricane, or the actual suspension of either portion when taking ground—we arrive at the conclusion that these calculations determine the strength, and that under any contingent circumstances we have given a wide margin, and fully determined the strength of the ship.

I am fully aware that many thousand vessels are now afloat that would not stand one-third of the tests I have taken as the minimum, but that is no reason why we should not endeavor to effect a more judicious distribution of material, and produce a maximum result, where the lives and fortunes of the public are at stake. On the question of security, we have fewer difficulties to contend with, and, so far as regards construction, I have endeavored to show, that in order to build a ship on principles as nearly perfectly secure as circumstances will admit, that she must be calculated to withstand the trials I have proposed her calculated to bear. Exclusive, however, of the simple strength of the hull, there are other considerations which require attention, such as the danger from fire, leakage, or total shipwreck.

In naval constructions we have three elements to contend with—fire, air, and water; and although we may effect in iron constructions extraordinary powers of resistance as respects the two latter, we are nevertheless subject to considerable risk as regards the former. It is true the hull of an iron ship will not burn, but the interior fittings, which are mostly of wood, if once ignited, might destroy everything on board, unless the necessary precautions are taken by iron bulkheads to cut off the communication from one division to another. From my own experience as a builder of iron vessels, I have found these bulkheads of inestimable value. They not only strengthen the ship transversely, but in case of injury to any part of the hull, any one of the divisions or compartments might be filled with water, and perhaps even the contents of that part burnt, without endangering the ship. These divisions, in fact, should be so arranged as to insure the vessel floating under circumstances of irreparable damage to any one of those parts of the ship. Again, in case of fire, under the lamentable position in which the Amazon was placed, it

might be advisable to have the extreme stem and stern bulkheads made double, with an air-space between them, and a valve in each to fill them with water up to the line of immersion, and thus prevent the division plates on that side clear of the fire from becoming red-hot, and igniting the timber fittings in that part which for the time might form a place of retreat. Much may be done in this way to mitigate, if not to avert, the calamitous and fatal consequences which ensue on those occasions. Bulkheads of this description, coming up to the underside of the upper deck, might obstruct to some extent the communication between decks from one compartment to another; but I believe a sufficient freedom of access from one part to another might easily be effected by well constructed iron doors, easily closed in case of accident, when they would become effectual barriers to the spread of destruction. In carrying these objects into effect, we must recur to the use of iron in every case where packet ships and steamers are employed. They apply with the same force to her Majesty's Navy, and particularly to steam frigates, and ships of war with auxiliary power. It is true, that the experiments already referred to of the dangerous effects of shot on the iron hull are alarming, but the amount of risk and destruction is always one of degree. I doubt whether the effects of shot on wooden vessels are less terrible, and undoubtedly the security gained by bulkheads and such contrivances are more than the claim to security. Besides, we are not yet satisfied that these effects are so dangerous as has been represented. On the contrary, I am of opinion that they have been greatly exaggerated, and that increased experience will ultimately show that the iron ship, under all circumstances, affords greater security, whether for war or commerce, than any other construction. As a proof of the advantages peculiar to iron as a material for ship-building, and the greatly increased security which it offers in comparison

Fig. 5.



with wood, the engraving, fig. 5, shows the condition of the steamer *Vanguard*, which ran foul of a reef of rocks on the west coast of Ireland, and continued beating upon them for several days with comparatively little injury. Another instance is that of the *Great Britain*, which stood the action of heavy seas beating her upon the sands and rocks of Dundrum Bay for the whole winter, and that without any serious damage to the hull.

Durability of Iron.—On this part of the subject, there is considerable

difference of opinion, but a very cursory view of this important question will at once show the great superiority which exists on the side of iron against timber. Although I proposed at starting to treat of metallic constructions alone, I have found it useful to add a few data, showing the strengths of different timbers which are used in combination with the metallic frameworks; and have therefore given the comparative strength of iron and the best English oak, in which it is proved that iron as a material is five times stronger than oak. This is, however, not the question which enters into the subject of durability, as the jointing of the one is incomparably superior to that of the other. In the building of ships of the line, or large merchant vessels, the keel, beams, and timbers are generally of oak or teak, made of three pieces, ingeniously contrived, and united by scarphs to each other to insure strength. The ribs or frames, which are solid and close to each other, are scarphed and jointed in the same way, and the outer sheathing, which is copper-fastened, is also attached with great care, and by crossing the vertical joints of the frames great strength is obtained. The connexion of the deck-beams to the frames by strong iron knees is another source of strength; but with all the care and ingenuity and skill bestowed upon this construction, it is far from perfect in point of strength, as the vessel, when pitching and rolling in a heavy sea, produces motion at every joint, and it not unfrequently happens that the seams open and close to an extent sufficiently obvious as to the nature of the structure and defective union of the parts. Now, in the iron ship we may venture to state, that when all the parts are soundly riveted together, there are no joints. The whole may be considered as continuous, consequently there can be no yielding, except from the elasticity of the mass to the action of the sea. The plates are the same as the planking or sheathing of timber-built ships, and these plates are riveted to strong iron ribs, varying from 12 to 15 inches asunder, and answering the same purpose as the solid framing of a teak or oak vessel. As respects the comparative merits of wood and iron vessels on the score of durability, I am of opinion that the public has entertained very erroneous views with reference especially to oxidation, which for the last twenty years has been the "rock ahead" of every iron ship. The extent of this evil has been greatly exaggerated, for there are instances of several iron vessels built twenty years ago, which are still in existence, with no sensible appearance of corrosion or decay, and what is of equal importance, without having required repairs, if we except a few coats of oil-paint, or the application of some other anti-corrosive substance, to neutralize the effects of the atmosphere upon the material. Nature, however, comes to our assistance in this as in almost every other attempt in the constructive arts, and seems to confirm the proverb that a "bright sword never rusts;" for it is with iron ships as with iron rails when in constant use, there is little if any appearance of oxidation. Taking, therefore, the whole circumstances into consideration, we may reasonably conclude that much has yet to be done in this department of the useful arts, and make no doubt that the iron ship of British origin will yet ride triumphant on every sea, as the harbinger of peace, the supporter of commerce, and the great and only security of our national defence.

If, in my attempt to elucidate a subject of such vast extent, and of such

ational importance, I have been successful in conveying to your minds ı plain words that knowledge which it is important we all should know, have attained the main object of my appearance in this place.

At the conclusion of the paper, a vote of thanks to Mr. Fairbairn was ıroposed and seconded, which was very warmly accorded.

Railway Accidents; their Cause and Means of Prevention; detailing particularly the various Contrivances which are in use, and have been proposed; with the Regulations of some of the principal Lines. By Captain M. Huish.*

The author first considered those points connected with the road, and he machinery employed upon it, from which loss of life and injury to erson and property most generally arose. With regard to the road or ermanent way, from which fewer accidents occurred than from any ther cause, its complete effectiveness was the basis of all safety in railray traveling; and for keeping it up, constant vigilance was necessary, specially when any great and sudden change of weather took place, as hen the weak points were sure to show themselves. It was a very rare ccurrence for trains to run off the line; and when they did so, it was ıore generally due to obstructions designedly placed on the line, than to ıny neglect of the superintendents or the plate-layers. It was little susected how frequent, how ingenious, and how varied the attempts had ecome to inflict a fearful injury by these means; and though, providenally, but comparatively trifling damage had resulted from such causes, et it was lamentable to find that in addition to all ordinary risks, so diaolical a mode of wreaking a petty vengeance, or gratifying a mischievous isposition, had to be guarded against. Of late, the punishment for such ffences had been made more severe; and it was to be hoped that this rould have the effect of lessening their number. Owing to the rapid developement of the traffic, and particularly of the heavy goods traffic, on ıe main arterial lines of the country, increased siding accommodation ad become necessary; in the case of the London and North-Western Railway alone, upwards of fifty-three miles had been laid down within he last few years, although, by multiplying points and crossings, this ıad, *pro tanto*, increased the liability to accident; for it might be received s an axiom, that any thing which broke the continuity of a rail tended o develope danger. As, however, there were no means of avoiding these requent "turns out," judicious regulations combined with effective sigıals must be relied on, and now that facing points were reduced in numıer, the liability to danger had been diminished. The use of self-acting witches was attended with evils of no trifling magnitude, and many acidents had occurred from reliance on them; indeed, as a general rule, machinery to supersede personal inspection and manipulation was fraught rith danger.

With respect to the rolling stock, it appeared from a return of one housand cases of engine failures and defects within two years on the London and North-Western Railway, that burst and leaky tubes nearly

* *From the London Civil Engineer and Architect's Journal, May, 1852.*

doubled any other class of failure; and that these, with broken springs and broken valves, amounted to one-third of the whole number; and though they caused no direct danger to the public, yet as producing a temporary or permanent inability of the engine to carry on its train, they might be the remote cause of collision. The passenger carriage, from its perfect manufacture, presented almost complete immunity from accident, for during the last four years, out of the large stock of the London and North-Western Railway, only six wheels had failed; and though at first some annoyance and alarm had been experienced from heated axles, yet by the recent introduction of the patent axle-box, it had been much reduced. The same praise could not be bestowed on the merchandise wagon, as in no portion of the system had so little improvement been made; the fracture of axles was frequent, the mode of coupling very defective, and the want of spring buffers, or even of buffers of the same height and width, rendered the destruction of property enormous. No loss of life from fire, either from heated coke or spontaneous combustion had occurred to a passenger train, but there had been some narrow escapes.

These and other circumstances had led many persons to suggest various contrivances for communicating between the passengers, the guards, and the engine-driver, almost all of which were identical in principle, consisting of a connecting wire or rope. This plan had been tried and failed. A more feasible and favorite one was that recommended by the Railway Commissioners, which was to continue the foot-boards, so as to form a narrow platform from end to end of the train; but a committee of railway officials had subsequently expressed their unanimous condemnation of the measure. The plan now adopted on the London and North-Western Railway was, for the guard's van, at the end of the train, to project about a foot beyond the other carriages, so that the guard looking through a window in this projection, might notice the waving of a hand or a handkerchief; this was, of course, useless at night.

All these causes, however, did not produce a tithe of the accidents which resulted from a want of attention to signals and a neglect of regulations, which of all sources of danger were the most prolific. Railway stationary signals had been greatly improved of late years, and the introduction of the lofty semaphores and the auxiliary signals really left little to be desired. Besides these, there were the hand signals, to be used by the guard in cases of stoppages between stations, and the detonating signals, to prevent collisions during a fog, which latter supplied the deficiency that had been experienced, and they were found to answer exceedingly well.

The electric telegraph had greatly facilitated working under variable circumstances, and so beneficial had its effects been, that, during the year 1851, out of 7,900,000 passengers, or nearly one-third of the population of England, who had traveled over the London and North-Western Railway, only *one* individual had met with his death, (from which casualty the author also suffered,) and this was the effect of the gravest disobedience of orders. In the six months during which the Exhibition was open, 775,000 persons were conveyed by excursion trains alone, in 24,000 extra carriages, centering in a single focus, arriving at irregular hours and

ost unlimited numbers, from more than thirty railways, without the rifling casualty, or even interruption to the ordinary extensive busif that line.

author thought undue importance had been attached to the ques' irregularity in the times of the trains, as an essential element of for with perfect signals and a well disciplined staff, no amount of larity should lead to danger; but, on the contrary, it should, to a ι extent, by its very uncertainty, induce increased vigilance, and ıre greater safety. Accidents very rarely happened from foreseen ıstances, but generally from a simultaneous conjunction of several , and each of these was provided for as it arose. The statistics of ys, and the periodical publication of the Government returns, drew attention very pointedly to the aggregate of accidents; but it was ed that if due regard was had to comparative results, if the acci:o steamers, or in mines, to omnibus passengers, or even to pedeswere as carefully recorded, that then, whether as regarded the nd celerity of transit, or the facility of conveying numbers, the railstem, even in its present state, would be found to be incomparably han any other system in the previous or present history of locomo-*Proc. Inst. Civ. Eng., April* 27, 1852.

AMERICAN PATENTS.

American Patents which issued from June 8th to June 29th, 1852, *(inclu-with Exemplifications by* Charles M. Keller, *late Chief Examiner of its in the U. S. Patent Office.*

an *Improvement in the Construction of Retorts for Chemical Furnaces;* John rill, Williamsburg, New York, June 8.

m.—"I disclaim all processes to which these retorts are applicable, and all chemipounds and mode of working the same, which are herein described; and I disclaim ipparatus shown herein, except as follows:

aim the retorts, H, formed by the arch, 7, and bed, 6, with the sides, 5, 5, and perwith the cross flues, 10, 12, or 13, below the bed and above the arch of each retort; orts being formed and operating as herein set forth, and being used for any pur-which they may be available."

Improvements in the Manufacture of Plate and Window Glass; Terence ark, Pittsburg, Pennsylvania, June 8.

invention consists, 1st, in a new and improved combination of machinery for rolle glass; and, 2d, for a new and improved construction of an oven for fire-polishing es or sheets of glass."

m.—"Having thus described my improved mode of making window or plate glass hinery, what I claim as my invention is, 1st, The use of hollow chilled iron rollers, manufacture of window and plate glass, in connexion with the mode of heating ith charcoal or other combustible placed inside.

The combination of the grooves with the strips and guides and the set screws, for pose of regulating the width and thickness of the sheet of glass.

The use of trucks, for carrying off the sheets of glass as they pass from the rollers said."

The combination and arrangement herein before described, of the gates, flues, and , in the *construction of the polishing* oven."

18. For an *Improvement in Processes for Preparing Oakum;* John A. and George Cormack, City of New York, June 8.

"The nature of our invention consists in the treatment of junk, or tarred ropes and such like materials, in an aqueous solution of sulphuric or muriatic acid, which solution or solutions imparts to the oakum manufactured from the junk new and useful qualities, not obtained by any other process heretofore known or practised."

Claim.—"We claim the treatment of junk, by steeping or rinsing it in acidulous liquor as described, for the purpose herein set forth."

---

19. For an *Improvement in Cow Catchers;* Cook Darling, Utica, New York, June 8.

Claim.—"What I claim as my invention is, the wheel and the guard, connected and arranged substantially as herein described, and for the purposes described."

---

20. For *Improvements in Cop Spinning Frames;* George H. Dodge, Attleborough, Massachusetts, June 8.

Claim.—"What I claim is, the toothed quadrant, y, the pinion, x, and its shaft, w, in combination with the two scroll cams, t, v, their chain, u, tubular shaft, f, and the clutch contrivance made with the spring click, g, and one single detent or opening, d, the whole being applied to the scroll shaft, L, and spur gear, M, and made to operate substantially in the manner and for the purpose as herein before stated.

"I also claim the ratchet wheel, w^2, the arm, b^3, and retaining pawl or click, c^3, or any mechanical equivalent therefor, in combination with the balance wheel apparatus, (viz: the arm, x^2, the fly wheel, y^2, its shaft and pinion, a^3,) and the spur gear, s^2, having a positive motion as described, the whole being for the purpose as specified.

"And in combination with the scroll shaft and its mechanism, for effecting the upward and downward movement of the ring rail, I claim the mechanism for effecting the change of the downward to the upward motion of the said rail, in an easy manner, and so as to prevent injurious strain, when the spring click, g, strikes into the recess, d, of the clutch flanch, c, the said mechanism consisting of the arm, f^3, roll, g^3, spring, h^3, tube, i^3, rod, k^3, cam, l^3, curved lever, m^3, and spring, o^3, or their mechanical equivalents, combined and operating together substantially as herein before described.

"I also claim the improvement of so applying or combining the thread guide G, or the guide bar or rail, u^3, to or with the ring rail and the frame, that the said guide or guide bar shall be movable, or made to move upwards and downwards, while the ring rail so moves, and this with a movement either equal to or in accordance with that of the ring rail, or a variable, as circumstances may require, the same being for the purpose as specified.

"And in combination with the scroll, z, its chain and connexions with the ring rail, I claim a compensature mechanism or apparatus, for regulating the action of the copping rail or rails on the said scroll, according to the leverage, or in other words, for providing a compensation for the difference of leverage produced by the swell, as described, the mechanism employed by me, and the combination of which I also claim, consisting of the two cams, d^4, e^4, the pullies, i^4, k^4, the chains, l^4, m^4, n^4, and weight, o^4, as applied together and to the frame, and operating substantially as specified.

"And I claim the bent arm and its projection, k, or other equivalent contrivance, in combination with the driving belt, shifting lever, or contrivance; the same being for the purpose as herein before set forth.

"And I also claim my improvement in the construction of the thread guide, G, the same consisting in making the opening of it straight on its rear side, substantially as seen at q^4, r^4; the same being for the purpose as herein before explained.

"And I also claim my improved or new combination of mechanism, by which a sudden or very quick rise of the copping rail is effected, in order to finish each upward movement, and this so as to wind as little yarn as possible at the nose or upper end of each conic layer composing the cop; the said combination consisting of the arm, l^3, upon the scroll shaft, L, the levers, k^2, m^2, the arm, c^1, and the rollers, b^1, p^2, as applied and operated together essentially as herein before specified."

For a *Smoke and Spark Deflector;* Albert Eames, Springfield, Massachusetts, June 8.

Claim.—"I do not wish to limit myself to the special form or position of the deflecting es, so long as the same end is attained by analogous means. What I claim as my ention is, the method of directing the discharge of smoke and sparks, or either, from chimney of a locomotive, by combining therewith deflectors, substantially such as ein described, the apertures thereof being governed by a valve or shutter, substantially specified."

For an *Improvement in Machinery for Making Spoons, Forks, &c.;* Alfred Krupp, Essen, Prussia, Assignor to Thomas Prosser, City of New York, June 8, 1852; patented in England, August 26, 1846.

Claim.—"What I claim is, the employment, for trimming the edges and giving the aments to the blanks, of a pair of rollers, each of which is furnished with a cutting edge l a device engraved within the same, and a space outside of said cutters, for the recep- of the waste; said rollers being so worked and applied to each other, that the cutting es of the one comes in contact with and cuts against the cutting edges of the other.

"I do not claim simply a movable die; but what I do claim is, a movable die, located hin the pattern dies, so that spoons or forks, having various crests, names, or initials reon, may be made by the same contour or device and edge pattern."

For an *Improved Process for Making Axes;* John Orelup, Assignor to Isaiah Blood, Augustus J. Goffe, and George R. Thomas, Ballston Spa, New York, June 8.

Claim.—"I claim the method of manufacturing axe poles by a process, of which the owing are its successive steps, in combination with other, as they are applied to the tal bar, when heated and prepared for manufacture, viz:

"1st, Spreading the iron bar at four points on its edges, by strokes of a peculiar tool de for the purpose.

"2d, Forming half eyes across the bar at spaces equidistant from its centre, by strokes a narrow and round edged hammer.

"3d, Finishing the half eyes, and making them equal and similar, on a swaging tool.

"4th, Cutting the bar partly through across its centre, and doubling together the halves the bar, so that the half eyes shall unite in correspondence with each other, and form eye of the axe, completing the whole ready for welding the two halves of the pole ether, substantially as the process is set forth in the above specification."

For an *Improvement in Reflector Lamps;* James H. Pease, Reading, Pennsylvania, June 8.

Claim.—"What I claim as my invention is, a reflector lamp, constructed substantially herein set forth, with a case containing a cooling liquid, for the protection of the reflector m injury, as herein described."

For an *Improvement in Wheel Cultivators;* Frederick P. Root, Sweden, New York, June 8.

Claim.—"Having explained my improvements in wheeled cultivators, I will here state t I am fully aware that there are other modes of raising and lowering the frame coning the teeth of cultivators in use, particularly that patented to David B. Rogers, Janu- 16th, 1849, which consists mainly of a combination of a crank axle-tree, extending ss the centre of the frame, on the ends or cranks whereof are mounted the sustaining eels; while I acknowledge the similarity of the lifting action of the cranks of the axle-, to that of the pivoted segment levers used by me, and which I disclaim; yet I am not are that Mr. Rogers is entitled to claim all means for effecting the same result, and I ceive that my improvements differ in material points from his, and which form the ject of my claims as follows:

"1st, Mounting the carriage wheels upon axles, only when said axles are made to pro- t from pivoted segment shaped levers at each side of the frame, in the manner and for purposes specified."

26. For *Improvements in Seed Planters;* James P. Ross, Lewisburg, Pennsylvania, June 8.

"My improvement consists in the seeding apparatus, by which the seed is conveyed in measured quantities from the hopper to the tubes, which conduct it into the teeth, and also in the mode of hoisting the teeth, by which a much larger range of motion can be given to the teeth than is practicable where levers are used; also, the mode of throwing the seeding apparatus into and out of gear; and, lastly, the measuring index for measuring the quantity of land seeded."

Claim.—"Having thus fully described my improvements, what I claim therein as new is, 1st, The seeding apparatus, constructed substantially in the manner and for the purposes set forth, consisting of the cup and receivers, the plate, gate, and their attachments.

"I also claim the mode of putting the cups into motion and stopping them, by shifting the pitman, as described, on to or from the eccentric, by the windlass, in the manner set forth.

"I also claim raising and holding the teeth by the employment of the apparatus for turning and holding the windlass, consisting of a crank and bevel wheels, as described, so that one man can easily raise the teeth to any desired height, and to a much greater range, than can be done by levers, or similar devices, and attach it in that position, by the revolving clutch, which meets, when at the proper height, with the crank which it fastens."

---

27. For an *Improvement in Harvesters;* George H. Rugg, South Ottawa, Illinois, June 8.

"The nature of my invention consists in the peculiar arrangement of the fingers which set over the sickle, and by which the sickle, with the aid of the rivets which will be hereinafter described, is prevented from being clogged."

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, the curved fingers, in combination with the rivets, projections below the sickle, by which means the sickle is prevented from being clogged or bound, substantially as described."

---

28. For an *Improvement in Seed Planters;* Benjamin D. Sanders, Holliday's Cove, Virginia, June 8.

"The nature of my invention consists in operating a shove rod, and thus distributing the seed, by means of a cam placed on the axle of the wheels, a greater or less vibration may be given the shove rod, by properly adjusting the cam, which is divided vertically into two parts, and having a greater or less distance between the two parts, the length of the vibration of the shove rod may be regulated, so that the grain may be distributed faster or slower, as desired."

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, the construction of the serpentine driving cam, E, the cam being formed of two parts, *f g*, and placed on the axle, F, the part, *f*, of the cam being fixed firmly to the axle, and the part, *g*, moving freely thereon, and secured at the desired point to the axle, by the set screw, *h*, each part of the cam being formed of a collar, having a zigzag or serpentine thread or projection upon it, the friction roller or bulb, G, at the lower end of the lever, D, fitting between the threads or projections which act against it, as the cam revolves, and give a reciprocating motion to the shove rod, C, substantially as described."

---

29. For an *Improvement in Hay Rakes;* Zenas Sanders, West Windsor, Vermont, June 8.

"The nature of my invention consists in attaching the teeth of the rake to the axle-tree or head of the rake, and in attaching and adjusting the thills to the same by hinges, in order to raise the teeth from the ground, and clear the same, by rolling and turning the axle-tree or head; and also in attaching and adjusting the whipple-tree to the same."

Claim.—"What I claim as my invention is, the construction of the axle and rake head, with hinges connecting it with the platform, in combination with the draft strap, to raise and depress the rake teeth, in the manner and for the purpose set forth."

30. For an *Improvement in the Construction of Soap Boilers;* John R. St. John, City of New York, June 8, 1852; patented in England, June 6, 1851.

Claim.—"Having thus described the construction and operation of my apparatus for heating, boiling, and mixing by steam, I desire it to be understood that I do not claim to be the original inventor of the application of steam to heating, boiling, and mixing; but what I do claim as my invention is, the combination of the steam jacket, tubes, and agitating rods, for transmitting and equally diffusing heat through soaps and other similar substances, where it is difficult to keep up an uniform heat throughout the mass, substantially in the manner set forth and shown."

31. For an *Improvement in Rat Traps;* John I. Vedder, Schenectady, New York, June 8.

"The nature of my invention consists in a novel and simple arrangement of mechanism, which is placed or arranged on the top of the trap, by means of which the rat, after he has been caught, is made, through his own weight, to reset the trap for his fellow rat, and after resetting the trap, he is precipitated into a tub or barrel filled with water, and drowned."

Claim.—"What I claim as my invention is, the employment of the pulley, cords, and inclined tilting passage; the whole being arranged as described, and operating in combination with the tooth, having a tilting door arranged on the top of the same, and a guard placed around the door, in the manner and for the purpose specified."

32. For an *Improvement in Grease Cocks;* Robert M. Wade, Wadesville, Virginia, June 8.

Claim.—"Having described my invention, what I claim therein as new is, the inclined discharge passage, of varying area, constructed, arranged, and operating, with respect to and in combination with the hollow cylinder, and its aperture, in the manner and for the purpose herein set forth."

33. For an *Improvement in Fastenings for Garments;* Elbridge G. Belknap, Spring Garden, Pennsylvania, June 15.

Claim.—"I claim the combination of the catch-plate with the plates above and below it, as shown and described. I claim the perforated bar for preventing the instrument from turning, the whole being arranged and acting substantially as set forth."

34. For *Improved Valves, or Gates, for Oblique Float Paddle Wheels;* Jacob C. Garncross, Philadelphia, Pennsylvania, June 15.

"The nature of this invention consists in placing at the edges next each other, of the obliquely arranged paddles of the wheel, a series of radial gates, turning on journals, and having right angled wings at their axis, for keeping them closed when they pass through the water, to prevent the water being moved laterly by the oblique paddles."

Claim.—"Having thus fully described my invention, what I claim as new is, the series of radial winged and pivoted gates, for preventing the water acted on by the paddles being moved laterally, as they move through the water, and opening to deliver the water freely, at the proper time, arranged and operating substantially as described."

35. For an *Improvement in Mills for Crushing Quartz;* John W. Cochran, City of New York, June 15.

Claim.—"Having described the manner in which I construct my machines, what I claim as my invention is, giving motion to the balls between the two plates or disks, in the manner and for the purpose substantially as above specified."

36. For an *Improvement in Piano Fortes;* William Compton, City of New York, June 15.

Claim.—"*I do not claim as new,* metallic frames, nor bridges, neither the upbearing

of the strings, nor bringing the strings to an equal length, other than in connexion with my arrangement; what I claim is, making the perforated bridge for the upbearing of the strings, a part of the solid arched frame or plate, as described."

---

37. For the *Manufacture of Granular Fuel from Brushwood and Twigs;* Reuben Daniels, Woodstock, Vermont, June 15.

Claim.—"I claim the granular fuel produced from brushwood and twigs, by cutting the same into lengths about equal to its average diameter, as herein described, as a new manufacture."

---

38. For an *Improvement in Cast Iron Car Wheels;* Peter Dorsch, Schenectady, New York, June 15.

Claim.—"I claim the double reversed corrugations, connecting the rim and hub, formed and acting as described and shown, and the combinations of these corrugated parts with the annular cylinder, between them and the hub, as described and shown."

---

39. For an *Improvement in Machines for Making Cigars;* William Dawson, Huntington, Connecticut, June 15.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, the manner herein described of making cigars, viz: by combining with the cutters and followers which cut off and feed in the requisite quantity of tobacco for each cigar, the rollers for rolling up the fillers and putting on the wrappers, said rollers having the requisite arrangement of parts, so as to open to receive the material, and close to form the cigar, and again open to deliver the finished article, in the manner substantially as herein described.

"I also claim the making of the roller which feeds in the wrapper, of less diameter than the rollers which form the filler, so that the filler may move at an increased velocity over that of the wrapper, for the purpose of more evenly spreading out the wrapper, and winding it more tightly upon said fillers, substantially as herein described."

---

40. For a *Machine for Polishing Daguerreotype Plates;* Townsend Duryea, Williamsburg, New York, June 15.

Claim.—"I do not claim the platform, nor frame, neither do I claim the reciprocating bed, separately; but what I claim as new is, the horizontal reciprocating bed, operated in the manner as described, or in any other equivalent way, in combination with the frame, for the purpose as herein specified."

---

41. For an *Improvement in Alarm Locks;* Charles Fleischel, City of New York, June 15.

Claim.—"Having thus described the nature of my inventions, their construction and operation, that which I claim as new is, the combination of the slide and button, constructed for the purpose of making and breaking the connexion of the bell and hammer with the bolt, catch, latch, or fastening of the lock, substantially in the manner I have described.

"I also claim the combination of the lever with the bolt and catch, or latch of the lock, by means of which, the movement of the catch is prevented, when the bolt is projected, and the catch is drawn by the same key which has drawn the bolt, constructed and operating substantially in the manner I have described."

---

42. For an *Improvement in Preparing Cotton Yarn for the Manufacture of Duck, and other Coarse Fabrics;* Horatio N. Gambrill, Baltimore, Maryland, June 15.

"The nature of my invention consists in passing the yarns, either single or in warps, and which are to be used without sizing, between, over and around rollers or heated pipes, which supply moisture, heat, and friction, for the purpose of softening, removing the elasticity of the threads, and condensing it, so as not to be chafed in the weaving, and so as to give the cloth the requisite body and pliability, to be more readily sown, and prevent its shrinking or stretching afterwards."

Claim.—"Having thus fully described my invention, what I claim therein as new is, the process herein described, of preparing yarns for coarse cotton goods, but more particularly for cotton duck, by passing them through between moistening rollers, or otherwise wetting them, and then passing them over or around grooved or plain heated steam pipes, or rollers, for removing their elasticity, smoothing and condensing them, whilst in a state of proper tension, substantially as herein described."

---

43. For an *Improvement in Organs;* Albert and George Gemunder, Springfield, Massachusetts, June 15.

Claim.—"What we claim as our invention is, the use of a separate air chamber for supplying wind to all the pipes of a single stop as herein described, and as opposed to the old method of having a single air chamber supply all pipes of the same note or letter in the different stops; and, finally, we claim the combination of air chambers, such as are herein described, with valves communicating with the several pipes, and operated by mechanical agencies, such as are shown in the foregoing description, explanations, and the accompanying drawings, substantially as herein described."

---

44. For an *Improvement in Carriage Axles;* Kingston Goddard, Philadelphia, Pennsylvania, June 15.

"The nature of my invention consists in making the box in two or more parts, with a recess to receive and embrace a collar on the journal part of the axle, or what is essentially the same, with a projecting fillet to fit into a recess in the journal part of the axle, when this is combined with the mode of securing and holding the said box on the axle, by making its periphery conical, to fit and be drawn into the hub, or into a pipe box fitted to the hub, so that by simply securing the said box within the hub or pipe box, the axle is at the same time secured within the box."

Claim.—"What I claim as my invention is, making the box in two or more parts, with a recess to embrace a collar on the journal part of the axle, or the equivalent thereof, substantially as described, when this is combined with the mode of securing together the section of the said box, by fitting it within the hub or pipe box, and securing it therein by a nut which embraces the several sections, and which secures them within the hub or pipe box, substantially as specified."

---

45. For an *Improvement in the Motion of the Lay in Looms;* John Goulding, Worcester, Massachusetts, June 15.

Claim.—"What I claim as my invention is, giving the lay of a loom one or more long beats for the shuttle to pass, or to insert a wire into the web, and as many short beats as may be necessary or desirable to strike up each thread of weft and wire, with a toggle joint, operated by a sweep or some other device, connected to or operated by a crank cam or otherwise."

---

46. For an *Improvement in Derricks;* Selah Hill, Jersey City, New Jersey, and Chas. H. Dupuy, jr., Rondout, New York, June 15.

"This invention consists in placing the axis upon which the jib of a derrick, crane, or similar apparatus swings, in a position slightly deviating from the vertical, by which means, with a proper arrangement of hoisting tackle, the jib can be swung, and its swinging can be entirely controlled by the hoisting tackle, while it is raising the weight."

Claim.—"What we claim as our invention is, placing the axis upon which the jib swings, in a position deviating from the vertical, so as to cause the jib to have a tendency to swing in one direction, and applying the hoisting tackle, or part of the hoisting tackle, in any manner substantially as described, to the side opposite to the direction in which the jib tends to swing, so as to make the hauling on the said tackle, or part of the tackle, swing the jib in the opposite direction to that in which is its tendency to swing when left free."

---

47. For an *Improvement in Preparations of Archil;* Leon Jarosson, City of New York, June 15.

Claim.—"Having thus fully described the nature of my invention, what I claim therein

as new is, mixing and treating lichen Rocellus with a volatile alkali, urine, and clear and fully saturated lime water, in the proportions and after the manner herein substantially set forth, for the purpose of producing a coloring matter known as archil."

48. For *Improvements in Machines for Jointing Staves;* Edwin Jenney, Middleborough, and David Rood, Boston, Assignor to Edward Jenny, Middleborough, Massachusetts, June 15.

"The object of our improvement is, to enable the cutters, or the cutter heads, to adapt themselves to the formation of the bilge or curves of the edges of a stave, as well as to joint the same, whatever may be the width of the stave submitted to them."

Claim.—"What we claim as our invention is as follows: in combination with each carriage or frame, we claim the clamping contrivance or mechanism, by which such carriage is held firmly in position, after being moved outwards by a stave, and while such stave is being reduced on its edges, or has the bilge formed on it, such contrivance or mechanism consisting of the movable bar, the rocker bar, the lever, connecting rod, and the clamping lever; the whole being applied to each carriage, and made to act on it as specified.

"And in combination with the lever, as applied and operated in the manner above set forth, we claim the mechanism by which the fulcrum of the lever is caused to move longitudinally, or towards the cam, for the purpose of producing the effect, equivalent to shortening the rear arm of the lever, and lengthening the front arm thereof, whereby the cutter head is made to depart further from the middle of the machine, so as to increase the curve of the bilge, or make it, as it were, with a diminished radius, such mechanism being the stationary slotted plate underneath the carriage or frame, as arranged and made to operate essentially as described.

"And in combination with the cutters, which produce the bilge curve, we claim the self-adapting planes, or plane irons, arranged in front of such cutters, and for the purpose of jointing or smoothing the edges of the bilge, as explained."

49. For an *Improvement in Saddles;* William S. Kennedy, Philadelphia, Pennsylvania, June 15.

"The nature of my improvement consists in employing, for the seat of the saddle, rattan, cane, or whalebone, or other material, substantially similar in its properties and operation, woven in the usual manner, of what is termed diagonal or chain weaving. Cane or rattan woven in this manner, has been long known and used, for forming the seats of chairs, and the manner of attaching the woven cane or rattan to the frame of the chair is also well known."

Claim.—"Having thus described my invention, what I claim therein as new is, the employment of woven rattan, cane, whalebone, or other similar elastic substance, in the construction of the seats of riding saddles, said seats, so constructed, being attached to and combined with the saddle-tree, in the manner and for the purposes above set forth."

50. For a *Machine for Wiring Blind Rods;* Frederick H. Moore, Ithaca, New York, June 15.

Claim.—"Having thus fully, clearly, and exactly described my invention, what I claim is, 1st, The combining of clenching mechanism, substantially such as herein described, with devices for feeding the rod and the wire, and piercing the former, and severing, forming, and inserting the latter, whereby I make and firmly attach blind staples in their proper positions, substantially as herein described.

"2d, I also claim the pivoted clencher, arranged and actuated substantially in the manner herein specified."

51. For an *Improvement in Hanging Mill Spindles;* Wm. H. Naracon, Auburn, New York, June 15.

"The nature of my invention consists in the use of linked sockets, for holding the upper stone upon the pivot of the spindle, and of an adjustable collar-bush, for holding the spindle to its step, constructed substantially as herein set forth."

Claim.—"What I claim as my invention is, the combination of the bail or balance ne, (of the usual shape,) with the cock-eye of the spindle, by means of the inverted earing cup, whose shank presses up through, and is made fast in the centre of the said ail, and whose head is enclosed in the inverted socket, which rises above and is made fast the top of the spindle, substantially as herein set forth."

2. For an *Improvement in Bedstead Fastenings;* Adam S. Newhouse, Richmond Co., Georgia, June 15.

Claim.—"What I claim as my invention is, securing the rail to the post, by means of n C, key D, and plate E, in the manner substantially as herein set forth."

3. For an *Improvement in Meat Cutters;* Joseph Potts, Yocumtown, Pennsylvania, June 15.

Claim.—"Having thus fully described my improvements in meat cutters, what I claim herein as new is, the mode of attaching the knives herein described, by which they can e taken out and replaced expeditiously."

4. For an *Improvement in Ore Stampers;* Thomas Keaney, Philadelphia, Pennsylvania, June 15.

"My improvement consists in adding weights above the stamper as the stamper wears way, so as to use it entirely up, or nearly so, before renewing it, which effects a great conomy in the use of the stamper."

Claim.—"Having thus fully described my improved stamper and its mode of operation, hat I claim therein as new is, the employment of weights upon the stamper, substantially s described, to keep up a uniformity of weight as the stamper wears, as herein set forth."

5. For an *Improvement in Hand Seed Planters;* Gelston Sanford, Ellenville, New York, June 15.

Claim.—"Having thus described the nature and operation of my invention, what I aim as new is, the method of conveying seed from the seed box, and depositing it in e furrow or hill, substantially as herein shewn and described, viz: by having the rods tached in any proper manner to a staff, said staff rods passing vertically through the bottom of the seed box, the upper part of the rods having cups attached to them by elastic ints, the cups having spurs projecting from them, which cant or turn over the cups, hen the staff and rods are raised, and throw the seed into the tops of the tubes, when ey catch under the projections, the lower ends of the rods forcing out the seed from the ibes, when the staff is depressed, and the springs retaining it when the staff is raised."

6. For an *Improvement in Harvesters;* William and Thomas Schnebly, City of New York, June 15.

Claim.—"1st, We claim as our invention, the arrangement of the bridges beneath e platform, in combination with chain bands, having accommodating knee formed fingers, r rakes, working on pivots and attached thereto, substantially as described.

"2d, We also claim working the vibrating cutter between an under and an upper open uard or finger, as described and represented."

7. For an *Improvement in Label Cards;* James Sharp, Roxbury, Massachusetts, June 15.

Claim.—"I claim the manufacture of label cards or tickets, of cloth and paper, struck nd pressed together, substantially as above described."

8. For an *Improvement in Machines for Making Cordage;* David Perry, Assignor to F. & J. W. Slaughter, Fredericksburg, Virginia, June 15.

Claim.—"*Having thus fully described* my improved rope and cordage making machine,

what I claim therein as new is, 1st, The arrangement and combination of the parts by which the machine is enabled to stop itself, when the sliver becomes exhausted, or nearly so, in any one of the cans, viz: by means of the movable bottoms, within the cans, connected to the rods, which pass through the tubular journals of the can frames, and descend below the disk, the arm fixed near the centre of the spring shaft, and the arm fixed near the projecting end of the said shaft, and the arm projecting from the side of the machine, or the respective equivalents of the said parts, when arranged, combined, and operating with each other and with the fixed pulley, and the loose pulley on the shaft, substantially in the manner herein set forth.

"2d, I also claim the corrugating of the sides of the cans, to prevent the sliver from rising therein, when it is pressed into the same, by which a much larger quantity of sliver can be placed in them, than can be placed in cans of the usual form.

"3d, In combination with the said corrugations in the sides of the cans, I also claim the perforating of the sides of the same, for the purpose of allowing the air to escape therefrom, when the sliver is compactly pressed into the cans.

"4th, I also claim the inserting of a wing, or wings, into each of the cans, for the purpose of preventing the combined annular and rotary motion which is imparted to the cans from twisting and kinking the slivers, as they rise therein to the upper tubular journals of the can frames, substantially as set forth."

59. For *Improvements in Sewing Machines;* Allen B. Wilson, Assignor to N. Wheeler, A. B. Wilson, Alanson Warren, and E. P. Woodruff, Watertown, Connecticut, June 15.

Claim.—"What I claim as my invention is, the combination of the bobbin for carrying one thread, with a rotating hook, which is of such form, or forms part of a disk, or its equivalent, of such form, as to extend the loop on the other thread, and pass it completely over the said bobbin, whereby the two threads are interlaced together; the parts being arranged and operating in any way substantially as herein set forth."

60. For an *Improvement in Machine for Stamping Ores;* Virgil Woodcock, Swanzey, New Hampshire, June 15.

Claim.—"I do not claim as my invention, the combination of the drum or pulley, K, the strap, I, the frame, B, its catch lever, and the cam at the top of the gins, as employed to elevate the ram or weight, and disengage it, so as to enable it to fall down on the bed or mortar; nor do I claim the arc, g^1, of cogs, and the two gears, N N^1, (applied to their two shafts,) for the purpose of alternately imparting a rotary motion to each shaft, as I am aware that such are old contrivances; but what I do claim as my invention is, the combination and arrangement of the said arc of cogs, and its wheels, the two spur wheels, N N^1, the shafts thereof, the drums, K K^1, straps, I I^1, frames, H H^1, their catch levers, and disengaging cams; the whole being applied to the two weights or rams, and made to operate, or alternately raise them, disengage them, allow them to fall, and afterwards re-engage them, all as specified.

"And in combination with the two spur gears, N N^1, and the arc gear, g^1, P, I claim the cam, k, on the wheel, P, the two spring catches i i^1, and the two pins or studs, h h^1, all arranged, applied, and made to operate, substantially in the manner and for the purpose as herein before specified."

61. For an *Improvement in Friction Clutch;* Wendell Wright, City of New York, June 15.

Claim.—"I do not claim as my invention, making a loose pulley fast with its shaft, by means of the friction of internal segments; but what I do claim as my invention is, operating the segments for producing friction on the inner surface of a loose pulley, by means of a thimble on the shaft of the pulley, connected with the segments by diagonal rods or braces, substantially as described."

62. For an *Improvement in Detaching Harness from Horses;* George Yellott, Bel Air, Maryland, June 15.

"The nature of my invention consists in so constructing the hames and saddle-tree of

e harness as to enable the driver, at any time, by a single pull of a cord, to detach the orse from the vehicle, so that the animal, stripped of the harness, goes off with nothing ut his collar, bridle, and reins attached."

Claim.—"What I claim as my invention is, the manner of constructing the hames, he saddle-tree, guard, and stop, as herein above described, so as to enable the driver, at ny time, to detach the horse, or horses, from the harness and buggy, carriage, or other ehicle, by a single pull or jerk of a cord."

---

3. For a *Machine for Washing and Amalgamating Gold, etc.;* Alexander Barclay, Newark, New Jersey, June 22.

Claim.—"What I claim as my invention is, the manner herein described of construct-ig the hollow revolving cylinder, to wit: with brackets along its periphery, and an inner artition near its discharge end, for separating, washing, and causing gold to amalgamate, the manner herein described."

---

l. For an *Improvement in Valves for Pumps;* Joel R. Bassett, Cincinnati, Ohio, June 22.

Claim.—"What I claim as new is, the device, consisting of a cylindrical box-valve, ith its inducting openings, and its side or water way openings, and its eduction openings, ad of a valve chest adapted thereto, with its induction, and side or water way, and luction openings, corresponding to the openings in the valve box; the whole, in connex-on with the usual water ways and barrel of a double acting pump, furnishing the parts ecessary to the operation of such a pump; thus obtaining from a single valve, deriving ts motion from the out-flowing and in-flowing currents, the result for which several sepa-ate valves have hitherto been needed, substantially in the manner described."

---

65. For an *Improvement in Bomb-Lance for Killing Whales;* Christopher C. Brand, Ledyard, Connecticut, June 22.

Claim.—"What I claim as my invention is, the mode of sustaining the fuse rope in e fuse tube, and preventing the fire of the charge of the gun from passing by the fuse pe and into the bomb, viz: by the two metallic tubular plugs, cast around the ends of e fuse rope and into the fuse tube, and arranged substantially as specified.

"I do not claim the application of wings or feathers, to a shaft or rod, to direct its pas-ge through the air; but what I do claim is, my improved mode of making them, viz: of lcanized india rubber, or other equivalent, so that they may not only resist the destruc-e powers of the explosion, but be folded down on the shank, when put into a gun bar-, and have the property of elasticity, such as will enable them to unfold themselves er being discharged from the gun."

. For an *Improvement in Heat Radiator;* Merrill Colvin, Rochester, New York, June 22.

Claim.—"Having described the construction and operation of my heat radiator, what claim as my invention is, the combination of the flue, I I, the cylindrical flue, the flue the receiver, G, the pipes, L L, and the open space, P; all operating in the manner nd for the purpose as herein described and set forth."

'. For an *Improvement in Horse Powers;* Aaron D. Crane, Newark, New Jersey, June 22.

Claim.—"What I claim as my invention is, 1st, The method of combining and arrang-g the two pallets as constructed, by a joint with the levers in such a manner, that by e action of the teeth of the main wheel against the end of these pallets, an oscillating otion is given to the levers; and by such motion, and the aid of the connecting rods and anks, a rotary motion is produced; but I do not claim the application of connecting rods nd cranks, for producing such rotary motion.

"2d, I do also claim the method of combining and arranging with the parts above aimed, the three eccentric wheels, running together in such a manner, that while the otion of the middle one is *uniform*, that of the other two on which the cranks act, is

irregular alternately; that irregularity being required, for the purpose of giving to the middle eccentric wheel a direct motion, not subject to being reversed, as it would be by using common wheels; all as herein before described for the purposes set forth.

"3d, I do not intend, by the foregoing claim, to limit myself to the application of this invention to horse powers, but to apply it as I may think proper, to other purposes, for driving machinery, when speed is required."

---

68. For an *Improvement in Dumping Wagon;* Abm. V. Cross, Washington, District of Columbia, June 22.

"The nature of my invention consists in so arranging a wagon as to adapt it to the ordinary purposes of road use, and by a mechanical device, enable the person having it in charge to readily discharge the load by dumping; the body, by its own weight, causing it to sink on an adjustable lever or inclined plane, simply arranged, and not liable to the objections and difficulties of complex contrivances."

Claim.—"What I claim as my invention is, the arrangement of the adjustable bar, or incline, and screw, in combination with the rollers, all operating in the manner substantially as shown and set forth in the foregoing specification and accompanying drawings."

---

69. For *Improved Wrought Nail Machinery;* Daniel Dodge, Keeseville, New York, June 22.

"My invention is such a combination and arrangement of the cutter, gripers, and hammers, that when a rod of suitable dimensions is introduced into the machine, a piece of sufficient length to form a nail will be cut off, caught into gripers, and passed under a series of hammers, receiving one stroke from each, as it progresses, and revolving during its transition, from one hammer to another, so that its different sides may be acted on alternately, until it has passed the entire series and is reduced to the requisite size and form, after which it is discharged."

Claim.—"Having thus described the nature of my invention, what I claim as new, is as follows: 1st, I claim the combination of a series of hammer faces with gripers, having both a rotary and progressive motion, and so arranged as to convey the blank between the several pairs of faces successively, at the same time revolving it so as to present different sides successively to the action of the hammers.

"2d, I claim such an arrangement of the several hammer faces, which act successively upon the blank, with regard to the distance of the lines in which they respectively move from the line in which the gripers move, that when the gripers move forward in said line, thereby conveying the blank from one pair of faces to another, the successive strokes which it receives, will fall on different points, thereby reducing different parts of it, successively, to the required size.

"3d, I claim, in combination with such an arrangement of the faces, with respect to the gripers, such a graduation, in the nearness with which the several pairs respectively approach, when they strike, that the several parts of the blank, upon which they respectively act, will be reduced to different sizes, and that the combined effect of the whole will be to reduce the nail to the proper form.

"4th, I claim the combination of the two kinds of faces, broad and narrow, with gripers so arranged as to present the blank to the action of the narrow ones, until it is suitably elongated, and subsequently to that of the broad ones, to receive a finish.

"5th, I claim the arrangement of a set of gripers upon the interior of a circular hub or frame, in combination with hammers placed in or near the centre of the circle in which they are arranged.

"6th, I claim adjusting the gripers, by means of a spring, or its equivalent, so arranged as to press them towards the hammers to their proper place, allowing them to recede as far as the lengthening of the nail requires, while the hammers are acting, and causing them to return again when the hammers are withdrawn.

"7th, I claim such a combination of stops for limiting the approach of the hammers to each other, with cams, or their equivalents, for forcing them together, as to diminish the inequality which unequal resistance between the faces, has a tendency to cause the springing of the parts which produce the stroke, thereby rendering the effect of the strokes uniform."

0. For an *Improvement in Sewing Machines;* Wm. O. Grover, Boston, and Wm. E. Baker, Roxbury, Massachusetts, June 22.

Claim.—"Having thus described our improved sewing machine, what we claim as our ivention is, the arrangement above described, in a sewing machine, for feeding the cloth long, consisting of a notched bar, which has a vertical or up and down motion, for fasten-ıg the cloth upon, and releasing it from the notches of said bar, by striking it against a ielding plate, and a lateral motion, or motion forward and back, for feeding the cloth long after each stitch, substantially as above set forth.

"We also claim a circular, instead of a straight, horizontal needle, for spreading the op of the thread of the vertical needle, substantially as above described."

1. For an *Improvement in Foot Car;* Nehemiah Hodge, North Adams, Massachusetts, June 22.

Claim.—"Having thus fully described my invention, what I claim in the construction foot cars as new is, suspending each of the treddles upon which the passenger operates om the same side of the axle, the treddles being so arranged as to rotate the axle, whetner ıey be applied both together, or one at a time, alternately, and through said axle, give otion to the driving wheels, substantially as herein described.

"I also claim combining with the axle and driving wheels, the fixed ratchets and spring awls, for the purpose of giving the driving wheels a continuous motion in one direction, hilst the axle may have an intermittent motion in the same direction, as herein repre-nted and described."

2. For an *Improvement in Clover Harvesters;* John Krauser, Reading, Pennsylvania, June 22.

Claim.—"What I claim as of my invention is, the hinged board, in combination with ıe movable cutter frame and the platform, as herein set forth.

"2d, I claim the shield, the same being constructed, applied, and operated in the man-er and for the purposes herein set forth and described.

"3d, I claim the combination of the lever, *f*, and lever, *n*, the latter being constructed t its posterior end, with slot and pivot pin, to admit of antero-posterior movement, and t its anterior end, with supports for cogged gearing, so that while the levers raise and epress the cutters, they also contribute to connect and sustain the gearing for driving ıe cutting reel."

3. For an *Improvement in Divided Railroad Car Axles;* Wm. S. Loughborough, Victor, New York, June 22.

Claim.—"I do not claim surrounding a divided axle with a tube; neither do I claim naking semi-axles of a conical form; but what I do claim as my invention is, the conical emi-axle, in combination with the tube, constructed as described, for the double purpose f giving the greatest strength to the axle itself with a given weight of metal, and of in-reasing the strength of the tube in the centre, without a corresponding increase of the xternal diameter thereof.

"Again, I do not claim a hollow divided tube, attached rigidly to the wheels and revolv-ing upon an undivided axle, to which it is secured by flanches, wings, and bolts; but what I do claim is, the peculiar manner of coupling the wheels and semi-axles to the hollow tube surrounding said axles, by the use of the groove in the hub of the wheel into which the flanch of the tube enters, in combination with the wing secured to the wheel by bolts as described, for the threefold purpose, first, of enabling the wheel and semi-axle to re-volve, independent of the tube, and of strengthening the axle at its weakest point where it enters the wheel; and lastly, to prevent the end of the tube from splitting out, by thus removing half the strain from the lower to the upper side, in the manner above set forth."

74. For an *Improvement in Steps and Bearings in Mill Spindles;* Theodore S. Min-nies, Meadville, Pennsylvania, June 22.

"My invention consists in sustaining and upbearing the gudgeons of shafts for mill spindles and other revolving bodies, upon, or by the pressure of fluids, in such a manner that the friction is vastly *diminished*, as hereinafter more fully described."

Claim.—"Having thus fully described my invention, I would observe that I do not claim upbearing or sustaining the gudgeons of shafts, or other revolving bodies, by liquids, when packing and force pumps are used, for giving the desired pressure, to sustain the weight of said shaft, or other body, and to prevent the lubricating liquid from overflowing; but what I do claim as new is, lessening the friction of mill spindles and other heavy revolving bodies, by upbearing and sustaining the gudgeon of the same upon any lubricating liquid, by the use of the hollow lighter, or case, *b*, with the case, *a*, for containing said liquid, upon which said lighter revolves, or their equivalents; said lighter being proportioned to the weight it is designed to sustain, and arranged and connected with the shaft, as described, or in any other manner substantially the same in principle, operation, and effect."

---

75. For an *Improvement in Planing Machines;* Nicholas G. Norcross, Lowell, Massachusetts, June 22.

Claim.—"I do not claim as my invention, the combination of one or more stationary planes, so arranged, that while one or more remove the rough surface of a board, the rest or last shall finish or producce on it a smooth plane surface; but I claim, when placed so as to operate on one side of a board, a cylindrical, rotary cutter, for roughing and reducing, which cuts from the unplaned to the planed surface, in combination with a stationary cutter, placed behind, and as near thereto as may be, for finishing without pressure rollers or pressure bars of any kind, whereby I am enabled to operate with greatly diminished power, and the rotary cutter will cut up and throw off the shavings from the stationary cutter, and the boards will be reduced to an equal thickness and a smooth surface."

---

76. For an *Improvement in Machines for Preparing Flocks;* John R. Peters, City of New York, June 22.

Claim.—"What I claim as of my invention is, 1st, the construction and arrangement of the fan wheel, and its combination with the elastic grinding bed or grater, constructed as described, or in any other manner substantially the same, for effecting the feeding, separating and discharging of the flocks and other matters mixed therewith, in the manner described.

"2d, I claim supporting or attaching the concave grater or grinding bed to the frame by springs, or other elastic material, for the purpose set forth.

"3d, I claim the reflectors and their arrangement in the machine, in the manner and for the purpose set forth; the whole being combined and operating substantially as described herein."

---

77. For *Improvements in Fluid Metres, &c.;* William H. Lindsay, City of New York, June 22.

Claim.—"What I claim as my invention is, in combination with a force pump and a piston, or plunger, actuated by water or other fluid, forced from the same, the air vessel and the drop valve arranged and actuated substantially as described, whereby the measuring piston or plunger is caused to pause at the end of each stroke, in either direction, substantially in the manner and for the purposes described.

"I also claim supplying the pump chamber and the metre chamber, through valves, arranged and operating as described, and loaded in proper relative proportions, or supplied from heads of proper proportional height, for the purpose herein described, height of head of supply, or amount of load on the valves, being equivalents, producing the same results.

"I also claim actuating the counter through the agency of a rack and a segment cog, arranged substantially as described, whereby any movement of the metre piston or plunger, less than a whole stroke, is counted up in proper proportion by the counter."

---

78. For an *Improvement in Ploughs;* David Swartz, Thomas Brook, Virginia, June 22.

Claim.—"Having thus fully described and represented my improved plough, what I claim therein as new is, combining a plough and harrow in one implement; that is to say, attaching a comb, or rake, or its equivalent, to the rear and upper end of the mould board, to comb out and pulverize the soil on the bottom of the furrow as it is turned up, substantially as set forth."

79. For an *Improvement in Time Pieces;* S. R. Wilmot, New Haven, Connecticut, June 22.

"The nature of my invention consists in connecting the corners or pillars of the clock-frame, to the sides or thickest parts of the case, thereby forming the junction of the said frame and case, at or between their most solid parts; and my invention further consists in supplying india rubber, or its equivalent, so as to interrupt all communication of solid matter between the clock and its case."

Claim.—"What I claim as my invention is, insulating or separating the clock frame, from all contact with the case, by intermediate packings of india rubber, or other non-conductor of sound, substantially as shewn and set forth."

---

80. For an *Improvement in Imitation of Stone;* Charles Iles, Birmingham, England, June 15, 1852; patented in England, April 26, 1849.

Claim.—"Having thus described the nature of my invention, and the manner of performing the same, I would have it understood that I do not confine myself to the details as herein described, so long as the peculiar character of either part of my invention be retained; but what I do claim is, the production of ornamental surfaces on picture frames, inkstands, and other articles, and on walls, and other places, and on different matters, by applying thereto colored silk, waste, or other colored fibrous substances, combined with cement, in such manner that the colored silk, waste, or other colored fibrous matter used, shall produce a veined, or marbled character."

---

81. For an *Improvement in Mill Stone Dress;* Wilson Ager, Rohrsburg, Pennsylvania, June 29.

Claim.—"Having thus fully described the nature of my invention, I wish it to be understood, that I do not claim the polishing of one stone by rubbing it with another of the same material; neither do I claim polishing the face of mill stones by rubbing it with another stone; as both these have been essayed. But what I do claim as my invention is, 1st, the rounding off of what is usually termed the feathered edge of mill stones for grinding buckwheat, so as to present a round, smooth surface, instead of a cutting edge, as herein set forth; and this I claim, whether said furrows are polished, sharpened, or straightened, by rubbing the same with a burr-block after said furrows have been roughed out with a pick or other tool, or by any other means substantially the same."

---

82. For an *Improvement in Hulling Buckwheat;* Wilson Ager, Rohrsburg, Pennsylvania, June 29.

Claim.—"Having thus fully described my invention, what I claim therein as new is, the method herein described of scouring or hulling buckwheat, by passing it through between horizontal stones, the runner having furrows on its face, drafted substantially as herein represented, and cut in the direction of the motion of the stone, with the design of keeping the grain from leaving the stone too fast, and for rotating them both on their short and long diameters, and the bed stone left without furrows, in the manner and for the purpose herein set forth."

---

83. For an *Improved Sail Hank;* Samuel Barker, City of New York, June 29.

Claim.—"Having described the nature of my invention, what I claim is, the construction of a divided hank, so formed that one part may embrace the stay, and the other part enter the eyelet of the sail, and the parts be connected together by the socket, or one receiving the shank of the other, and be confined by the bolt, for the purpose of securing sails to the stay, substantially in the manner set forth and shown."

---

84. For *Apparatus for Propelling Vessels;* Matthew A. Crooker, City of New York, June 29.

"The principle aimed at by me in this invention is, to produce a movement somewhat in imitation of that employed in nature by aquatic birds for their propulsion, as ducks, geese, &c.; in place of the contraction of the paddle, to represent the movement of the

foot, the former is lifted from the water, but the act of propelling is sought to be the same."

Claim.—"What I claim as my invention is, the combination of the radius bars, upright levers, cranks, horizontal levers, carrying paddles, and curved slots, arranged with respect to each other, and connected and operating substantially in the manner set forth herein."

---

85. For an *Improved Revolving Last Holder;* Henry C. De Witt, Napanock, New York, June 29.

Claim.—"What I claim as my invention is, 1st, The revolving stock, constructed, and arranged, and operating in the manner substantially as and for the purpose herein set forth.

"2d, The revolving last holder, attached to the revolving stock, and having an adjustable rest or arm; the whole being constructed, arranged, and operating in the manner substantially as and for the purpose herein specified."

---

86. For an *Improvement in Railroad Car Trucks;* Caleb R. Disbrow, Bath, New York. June 29.

Claim.—"Having described the nature of my improved safety truck for railroads, what I claim is, the construction of a truck with independent wheel frames, strengthened by braces, and connected to the opposite side wheel frame, by the bar extending across the truck, upon which said wheel frames may vibrate, substantially in the manner and for the purposes set forth and shown."

---

87. For an *Improvement in Potato Diggers and Stone Gatherers;* John T. Foster, City of New York, June 29.

Claim.—"Having now set forth the nature of my invention, what I claim is, the use of the roller, having a series of rows of pins in its periphery, and secured on an axle-tree of a cart or other moving apparatus, in combination with an adjustable apron having teeth in it, and a discharging plate having teeth in it, substantially for the purpose of gathering stone, potatoes, fruit, or other substances or articles, and depositing them in a box, as herein before set forth."

---

88. For an *Improved Lock;* Francis Garachon, City of New York, June 29.

"The nature of my invention consists in the arrangement of the lock, a check lever and its accessories, for latching and unlatching the bolt, relatively to a check lever for locking the revolving plate, whereby the auxiliary key acts upon the former by being lifted endwise, and upon the latter by its bit, when revolving in the usual manner."

Claim.—"What I claim is, the arrangement of the lever and its accessories, for latching and unlatching the bolt, relative to the lever, or locking the revolving key-plate, whereby the auxiliary key acts upon the former by being lifted endwise, and upon the latter by its bit, when revolving in the usual manner, substantially as set forth."

---

89. For an *Improvement in Hanging Steps of Mill Spindles;* Gideon Hotchkiss, Windsor, New York, June 29.

Claim.—"Having thus fully described my tram-block and bridge-tree, what I claim as my invention is, the manner of connecting the tram-block foundation with the stone bearers, by means of stanchions and screw-bolts, as specified, in combination with the method of suspending the lighter lever from the shell which guides and sustains the pot, containing the step of the spindle, by means of the shell, the sway bar, and the knife edges of the sway bar and pot, or their equivalents, in manner and for the purposes substantially as described."

---

90. For an *Improvement in Bedstead Fastenings;* Jasper Johnson, Genesee, New York, June 29.

Claim.—"I do not claim a bedstead fastening composed of a stub bolt, drawn tight on an inclined plane, as that is well known; but what I do claim is, the combination of the

fastening, composed of the stub bolt and the inclined plane, or their equivalents, drawn tight by the cording of the bedstead, with the endless screw, acting upon the inclined plane by means of cogs or other equivalent device, in order, by turning the inclined plane under the bolt, to loosen, separate, or tighten again the fastening, without the necessity of slacking the cording."

---

91. For *Improvements in Moulding Hollow Ware, &c.;* James J. Johnston, Cincinnati, Ohio, June 29.

Claim.—"What I claim as new is, the method of moulding hollow ware, or other similar castings, with a flaring rim or its equivalent, (such as the lip on cannon stove or other tubular castings,) by using third patterns, attached to suitable match plates or follow boards, and so devised that, in connexion with the first and second patterns which form the exterior, I mould therefrom the top edge, a portion of the interior of the desired casting, and a true seat for the core, thus, with the core, forming the entire mould, substantially as described and represented."

---

92. For an *Improved Method of Heating Sheet Iron while in the Process of Manufacture;* Henry M'Carty, Pittsburg, Pennsylvania, June 29.

Claim.—"Having described my improvement in the manufacture of sheet iron, by which it is made to resemble the imported Russia sheet iron, and possess that beautiful mottled gloss and smooth hard surface, what I claim as new and of my invention is, heating the sheets of iron in a bath of hot lead, instead of heating them in an oven, by which the surfaces of the sheets are protected from the oxygen in the atmosphere, during the heating process, preparatory to the rolling operation."

---

93. For an *Improved Compound Anchor;* Samuel Nye Miller, Roxbury, Massachusetts, June 29.

Claim.—"What I claim as my invention is, the above described anchor for holding ships."

---

94. For an *Improvement in Mixing Mortar;* Jesse Peck, Buffalo, New York, June 29.

Claim.—"What I claim as my invention is, the mixing of lime and sand together, before straining, substantially in the manner and for the purpose herein set forth."

---

95. For an *Improvement in Locomotive Engines;* Henry R. Remsen and P. M. Hutton, Troy, New York, June 29.

"This invention relates to the employment of a locomotive engine, of three cylinders, whose cranks are arranged at angles to each other of about 120°, with valves, valve chests, steam and escape pipes, so arranged as only to admit steam to one side of the pistons when the locomotive is advancing, and the other side when it is backing, the reversal being accomplished by such change of the operation of the steam, without recourse to any of the ordinary means of reversal."

Claim.—"What we claim as our invention is, the combination in a locomotive engine, of three cylinders, whose cranks are at angles of about 120° to each other, with valves, valve chests, escape pipes, and steam pipes, provided with throttle valves, substantially such as are herein described, whereby the steam acts only on one side of the pistons when the locomotive is advancing, and upon the other when it is backing, and the reversal is accomplished by such change in the operation of the steam, without recourse to any of the ordinary means of reversal."

---

96. For an *Improvement in Skates;* Nathaniel C. Sanford, Meriden, Connecticut, June 29.

"The nature of my invention consists in a peculiar manner of forming the runner, viz. out of a plate of steel, tapered at one end, said plate, by means of a die or any other proper mode, being struck or thrown into the required form."

Claim.—"Having thus described my invention, what I claim as new is, making the

runner out of a plate of steel, and of the form substantially as shown and specified, the plate being turned or struck the desired form by means of disks, or in any other desirable way."

97. For an *Improved Belt Clasp;* Albert M. Smith, Rochester, New York, June 29.

Claim.—"What I claim as my invention is, the making clasps to fasten belts or bands together, to run on machinery or around pullies, by using jaws or plates of metal, constructing and adapting them to that purpose, and then confining them together with screws, so as to hold the belts solid, and thereby introducing a new and useful manner of fastening machine belts together."

98. For an *Improvement in Method of Ringing Bells;* Thomas V. Stran, New Albany, Indiana, June 29.

Claim.—"What I claim as my invention is, the combination and arrangement of the levers and the compound levers, so connected and attached to the axle as to give motion to the bell clapper, in the manner and for the purposes herein shown and set forth."

99. For an *Improvement in Brick Machines;* R. A. Ver Valen, Haverstraw, New York, June 29.

Claim.—"I do not claim the plunger or follower, operated by a connecting rod or crank, as that is well known; but what I claim as new is, 1st, The employment or use of the lever H, having step projections, b^1 b^2, on one of its sides, attached to the connecting rod, C, and arranged as shown and described, by which a greater or less pressure of the plunger or follower upon the clay in the moulds is obtained, as desired.

"2d, I claim the arrangement of the levers, I, J, N, rods, K, L, vertical lever, M, and the rod, O, with the levers, P, S, and upright shaft, R, for the purpose of operating the feeder, T, and vibrating bar, U, substantially as set forth.

"3d, I claim the employment or use of the spring, Y, attached to the vertical lever, M, and operated upon by the rods, *r*, *r*, attached to the lever, whereby the working of the machine is prevented by any obstruction, as described.

"4th, I claim the attaching together of the feeder, T, and vibrating bar, U, the vibrating bar having a guide rod, *m*, working in suitable bearings, *n*, *n*, or arranged in any other suitable way."

100. For an *Improvement in Sofa Bedsteads;* Alfred Walker, New Haven, Connecticut, June 29.

Claim.—"What I claim as my invention is, the manner of guiding the seat when it is raised and lowered, and of connecting the seat and bed when extended, by means of the metallic bearings, and the grooves which they traverse, when the seat is raised and lowered."

101. For an *Improvement in Railroad Cars;* Charles Waterbury, Bridgeport, Connecticut, June 29.

"The nature of my invention consists in constructing the ends of railroad cars in such a manner, that an enclosed communication may be had from one car to the other, so as to protect the lives of passengers while passing from one car to the other."

Claim.—"What I claim as my invention is, an enclosed passage or communication from one car to the other, as herein described, for the purpose of ventilating the train through the ends of the cars, from the forward part of the train, and for the safety of the passengers, while passing from one car to the other, and for the purpose of keeping dust out of the cars, when the train is in motion."

102. For an *Improvement in Connecting Cocks with Pipes;* Daniel A. Webster, City of New York, dated June 29, 1852; ante-dated December 29, 1851.

Claim.—"Having thus fully described my invention, what I claim therein as new is, the manner herein described of making a tight joint, viz: by boring the hole in the pipe as

nearly cylindrical as may be, and making that part of the cock which is to be inserted, near the end and near the shoulder, of equal diameter with the holes, and the central part slightly larger, and then driving the cock into its place—the edges of the hole shaving the cock to its proper size and form.

---

103. For an *Improvement in Sugar Boiling Apparatus;* Juan Ramos, Island of Porto Rico, Assignor to James C. Gallagher, Philadelphia, Pennsylvania, and William F. Tirado, Ponce, Island of Porto Rico, June 29; patented in Spain, April 29, 1851.

Claim.—"What I claim as my own invention and discovery is, the construction of the transverse canal, in combination with the hinged cover, for the double purpose of returning the froth to the receiving pans, and for preventing the syrup from falling into the canal, while being laded from one pan to the other.

"I also claim the construction of the lower longitudinal canal, with its hinged board, for the purpose of more effectually removing the feculencies, as described.

"I also claim the use of the movable plank in the coolers, which when removed, leaves a vacancy or channel for the molasses to flow away to the discharge aperture, through the bottom of the cooler."

---

104. For an *Improvement in Processes for the Manufacture of Sugar;* Juan Ramos, Island of Porto Rico, Assignor to James C. Gallagher, Philadelphia, Pennsylvania, and William F. Tirado, Ponce, Island of Porto Rico, June 29; patented in Spain, April 29, 1851.

Claim.—"What I claim as my own invention and discovery is, the use of the juice of the plaintain stalk and quicklime combined, substantially in the manner and for the purpose described, for defecating the cane juice.

"I also claim the application of a fresh strike of concentrated syrup from the battery to the molasses first drained off, for the purpose of crystalizing the sugar yet remaining in the molasses."

---

105. For an *Improvement in Revolving Boot Heels;* Thomas Walker, Birmingham, England, Assignor to Benjamin B. Thayer, Quincy, Assignor to Wm. W. Churchill, Boston, and John Baxter, Quincy, Massachusetts, June 29; patented in England, July 1, 1849.

Claim.—"What I claim as my invention is, the combination of the four separate pieces, that is to say, the metallic ring, the leather or flexible disk, the leather annulus or ring, and the leather disk, the said combination being represented in fig. 1, and constructed, arranged, and made to operate together, substantially as herein before described."

Re-issues for June, 1852.

1. For an *Improvement in the Machine for Cutting Paper and Trimming Books;* Frederick J. Austin, City of New York; dated June16, 1841; ante-dated December 16, 1840; re-issued June 22, 1852.

Claim.—"What I claim as my invention is, the use of a knife having a lateral or end vibratory motion, for the purpose of cutting the edges of books, paper, &c., and its combination with the frame and rods, or either of them, and operated by cams or other equivalent devices, to give a drawing and vibratory cutting action to the knife, substantially as set forth.

"I claim also the mechanical construction of the press, as arranged and combined with the parts for cutting and pressing, thereby forming an entire machine for the purpose described."

---

2. For an *Improvement in Batting of Cotton, or other Fibrous Material;* Hamilton B. Lawton and Hiram T. Lawton, Troy, New York; patented March 13, 1849; re-issued June 22, 1852.

Claim.—"*We do not claim as our invention* the mode of operating a series of carding

machines to make batting, as shown by J. Essex's drawings, nor any part of the above described machine. What we do claim as our invention and discovery is, the method of making batting or wadding by laying on and covering both the upper and lower surfaces of a sheet or sheets of cotton, wool, hair, or other elastic fibrous material, that has been merely well picked, cleaned, and spread, with layers of carded, condensed, and compact fibres, such as cotton, wool, hemp, &c., for the purpose of rendering the same smooth, strong, and more suitable for bedding, wadding, and upholstery uses."

Designs for June, 1852.

1. For a *Design for a Portable Grate;* David Thomson, Boston, Massachusetts, Assignor to New Market Iron Foundry, of Boston, June 8.

Claim.—"What I claim as my production is, the new design, consisting of the sunken panels, leaf scrolls, and ornamental mouldings, herein above described and represented in the drawings, for the front of a portable grate."

---

2. For a *Design for a Parlor Stove;* Samuel D. Vose, Albany, New York, June 22.

Claim.—"I do not claim any detailed part of the mouldings or configuration. What I claim as my invention is, the combination of the several mouldings and ornaments as arranged together, the whole forming an ornamental design for a parlor stove, as herein set forth and described."

---

3. For a *Design for a Coal Stove;* Samuel D. Vose, Albany, New York, June 22.

Claim.—"I do not claim any detailed part of the mouldings or configuration. What I claim as my invention is, the combination of the several mouldings and ornaments as arranged together, the whole forming an ornamental design for a coal burner stove, as herein set forth and described."

---

4. For a *Design for a Box Stove;* Samuel D. Vose, Albany, New York, June 22.

Claim.—"I do not claim any detailed part of the mouldings or configuration. What I claim as my invention is, the combination of the several mouldings and ornaments as arranged, the whole forming an ornamental design for a box stove, as herein set forth and described."

---

5. For a *Design for a Parlor Cook Stove;* Samuel D. Vose, Albany New York, June 22.

Claim.—"I do not claim any detailed part of the mouldings or configuration. What I claim as my invention is, the combination of the several mouldings and ornaments as arranged together, the whole forming an ornamental design for a parlor cook stove, as herein set forth and described."

---

6. For a *Design for a Dining Room Stove;* William L. Sanderson, Troy, Assignor to R. Finch, Sr., and Reuben Finch, Jr., Peekskill, New York, June 22.

Claim.—"What I claim as my invention is, the ornamental form, design, and configuration, as herein described and represented, of the stove as a whole, and also of the several plates, the feet, and vase, separately."

---

7. For a *Design for a Cooking Stove;* S. W. Gibbs, Albany, New York, Assignor to North, Harrison & Chase, Philadelphia, Pennsylvania, June 22.

Claim.—"What I claim as my invention is, the design and configuration of the ornaments and mouldings herein described, constituting a design for a cooking stove."

---

8. For a *Design for a Cooking Stove;* James H. Conklin, Assignor to R. Finch, Sr., and Reuben Finch, Jr., Peekskill, New York, June 29.

Claim.—"What I claim as my invention is, the design, combination, and arrangement of the several mouldings and ornaments upon the plates forming the stove, and also the configuration of the mouldings and ornaments upon each of the doors, and of the feet, substantially as described and represented."

MECHANICS, PHYSICS, AND CHEMISTRY.

Observations on Etherification. By THOMAS GRAHAM, F. R. S., F. C. S., &c.*

In the ordinary process of etherizing alcohol by distilling that liquid with sulphuric acid, two distinct chemical changes are usually recognised; namely, first, the formation of sulphovinic acid, the double sulphate of ether and water; and secondly, the decomposition of the compound named, and liberation of ether. The last step, or actual separation of the ether, is referred to its evaporation, in the circumstances of the experiment, into an atmosphere of steam and alcohol vapor, assisted by the substitution of water as a base to the sulphuric acid, in the place of ether. The observation, however, of M. Liebig, that ether is not brought off by a current of air passing through the heated mixture of sulphuric acid and alcohol, is subversive of the last explanation, as it demonstrates that the physical agency of evaporation is insufficient to separate ether. Induced to try whether ether could not be formed without distillation, I obtained results which appear to modify considerably the views which can be taken of the nature of the etherizing process.

The spirits of wine or alcohol always employed in the following experiments, was of density 0·841, or contained 83 per cent. of absolute alcohol.

Expt. 1.—One volume of oil of vitriol was added to four volumes of alcohol, in a gradual manner, so as to prevent any considerable rise of temperature. The mixture was sealed up in a glass tube, 1 inch in diameter and 6·6 inches in length, of which the liquid occupied 5·2 inches, a space of 1·4 inch being left vacant, to provide for expansion of the liquid by heat. The tube was placed in a stout digester containing water, and safely exposed to a temperature ranging from 284° to 352° (140° to 178° C.) for one hour.

No charring occurred, but the liquid measured on cooling, 5·25 inches in the tube, and divided into two columns, the upper occupying 1·75 inches, and the lower 3·5 inches of the tube. The former was perfectly transparent and colorless, and on opening the tube, was found to be ether, so entirely free from sulphurous acid, that it did not affect the yellow color of a drop of the solution of bichromate of potash. The lower fluid had a slight yellow tint, but was transparent. It contained some ether, but was principally a mixture of alcohol, water, and sulphuric acid. The salt formed by neutralizing this acid fluid with carbonate of soda, did not blacken when heated, from which we may infer that little or no sulphovinic acid was present.

The principal points to be observed in this experiment, are its entire success as an etherizing process, without distillation, without sensible formation of sulphovinic acid, and with a large proportion of alcohol in contact with the acid, namely, two equivalents of the former nearly, to one of the latter. When the proportion of the alcohol was diminished, the results were not so favorable.

* *From the Journal of the London Chemical Society*, Vol. III., 1851.

Expt. 2.—A mixture of one volume of oil of vitriol and two volumes of alcohol, sealed up in a glass tube, was heated in the same manner as the last. The liquid afterwards appeared of an earthy-brown color by reflected light, and was transparent and red by transmitted light. Only a film of ether was sensible after twenty-four hours, floating upon the surface of the dark fluid.

Expt. 3.—With a still smaller proportion of alcohol, namely, one volume of oil of vitriol with one volume of alcohol, which approaches the proportions of the ordinary etherizing process, a black, opaque liquid was formed at the high temperature, thick and gummy, without a perceptible stratum of ether, after standing in a cool state.

Crystals of bisulphate of soda, containing a slight excess of acid, were found to etherize about twice their volume of alcohol, in a sealed tube, quite as effectually as the first proportion of oil of vitriol, when heated to the same temperature. The two liquids found in the tube were colorless, no sulphurous acid appeared, and only a minute quantity of sulphovinic acid.

Crystals of bisulphate of soda, which were formed in an aqueous solution and without an excess of acid, had still a sensible but much inferior etherizing power.

Expt. 4.—A mixture was made of oil of vitriol with a still larger proportion of alcohol, namely, 1 volume of the former and 8 of the latter, or nearly 1 equivalent of acid to 4 equivalents of alcohol. This mixture was sealed up in a tube and heated for an hour between 284° and 317° (140° and 158° C.), which appeared sufficient for etherizing it. A second exposure for another hour to the same temperature did not sensibly increase the ether product. The column of ether measured 1·25 in the tube, and the acid fluid below 2·5 inches. Both fluids were perfectly colorless.

It thus appears to be unnecessary to exceed the temperature of 317° (158° C.) in this mode of etherizing, and that the proportion of alcohol may be increased to eight times the volume of oil of vitriol without disadvantage.

Expt. 5.—The proportions of the first experiment were again used, namely, 1 volume of oil of vitriol with 4 volumes of alcohol, and the mixture heated as in the last experiment to 317° (158° C.) The upper fluid, or ether, measured 1·1 inch in the tube; the lower fluid 2·65 inches. The latter had a slight yellow tint, like nitrous ether, but only just perceptible. It gave, when neutralized by chalk:

Sulphate of lime . . .	83·11 grains.
Sulphovinate of lime . .	4·91 "

The last salt was soluble in alcohol, and crystallized in thin plates.

Here again the formation of sulphovinic acid in a successful etherizing process is quite insignificant.

New results at 317°, from the other proportions of 1 volume of oil of vitrol with 1 and 2 volumes of alcohol, were quite similar to those obtained in experiments 2 and 3, at the higher temperature of 352°. In none of these experiments, did there appear to be any formation of olefiant gas, and the tubes could always be opened, when cool, without danger.

Neither glacial phosphoric acid nor crystalized biphosphate of soda *etherized* alcohol to the slightest degree, when heated with that sub-

stance in a sealed tube, to 360° (182°C.). Even chloride of zinc produced no more, at the same temperature, than a trace of ether, perceptible to the sense of smell.

Expt. 6.—To illustrate the ordinary process of ether-making, a mixture was prepared, as usually directed, of:

100 parts of oil of vitriol,
48 " of alcohol (0·841),
18·5 " of water.

This liquid was sealed up in a glass tube, and heated to 290° (143° C.) for one hour. It became of a dark greenish-brown color, and opalescent, with a gummy looking matter in small quantity. No stratum of ether formed upon the surface of the fluid.

The tube was opened and the fluid divided into two equal portions. One of the portions was mixed with half its volume of water, and the other with half its volume of alcohol, and both sealed up in glass tubes and exposed again to 290° for one hour.

It would be expected, on the ordinary view of water setting free ether from sulphovinic acid, that much ether would be liberated in the mixture above, to which water was added. The ether which separated, however, amounted only to a thin film, after the liquid had stood for several days. In the other liquid, on the contrary, to which alcohol was added, the formation of ether was considerable, a column of that liquid appearing, which somewhat exceeded half the original volume of the alcohol added. In fact, the sulphovinic acid was nearly incapable of itself of yielding ether, even when treated with water. But it was capable of etherizing alcohol added to it, in the second mixture, like bisulphate of soda or any other acid salt of sulphuric acid.

The conclusions which I would venture to draw from these experiments are the following:

The most direct and normal process for preparing ether, appears to be, to expose a mixture of oil of vitriol with from four to eight times its volume of alcohol of 83 per cent., to a temperature of 320° (160° C.), for a short time. Owing to the volatility of the alcohol, this must be done under pressure, as in the sealed glass tube. The sulphuric acid then appears to exert an action upon the alcohol, to be compared with that which the same acid exhibits when mixed in small proportions with the essential oils. Oil of turpentine, mixed with one-twentieth of its volume of sulphuric acid, undergoes an entire change, being chiefly converted into a mixture of two other hydrocarbons, terebene and colophene, one of which has a much higher boiling point and greater vapor-density than the oils of turpentine. This hydrocarbon does not combine with the acid, but is merely increased in atomic weight and gaseous density without any further derangement of composition, by a remarkable polymerizing action (as it may be termed) of the sulphuric acid. So of the hydrocarbon of alcohol; its density is doubled in ether, by the same polymerizing action. Chloride of zinc effects, with alcohol, at an elevated temperature, a polymeric catalysis of the latter, of the same character, but in which hydrocarbons are formed, of even greater density and free from oxygen.

This view of etherification is only to be considerd as an expression of

the contact-theory of that process which has long been so ably advocated by M. Mitscherlich.

The formation of sulphovinic acid appears not to be a necessary step in the production of ether; for we have found that the etherizing proceeded most advantageously with bisulphate of soda, or with sulphuric acid mixed with a large proportion of alcohol and water, which would greatly impede the production of sulphovinic acid. It appears, indeed, that the combination of alcohol with sulphuric acid, in the form of sulphovinic acid, greatly diminishes the chance of the former being afterwards etherized; for when the proportion of oil of vitriol was increased in the preceding experiments, which would give much sulphovinic acid, the formation of ether rapidly diminished. The previous conversion of alcohol into sulphovinic acid, appears, therefore, to be actually prejudicial, and to stand in the way of its subsequent transformation into ether.

The operation of etherizing has attained a kind of technical perfection in the beautiful continuous process now followed. The first mixture of alcohol and sulphuric acid is converted into sulphovinic acid, the sulphate of ether and water, which acid salt appears to be the agent which polymerizes all the alcohol afterwards introduced into fluid. Bisulphate of soda, with a slight excess of acid, acts upon alcohol in the same manner, and its substitution for the acid sulphate of ether would have a certain interest, in a theoretical point of view, although a change of no practical importance in the preparation of ether.

Sulphuric acid does not appear to be adapted for the etherizing of amylic alcohol. M. Balard, by distilling these substances together, obtained a variety of hydrocarbons, some of them of great density, but no ether. The polymerizing action of the sulphuric acid appears to advance beyond the ether stage. I have varied the experiment by heating amylic alcohol, in a close tube, to 350° (176° C.) with oil of vitriol, to which 1, 2, 3, 4, and even 6 equivalents of water had been added, without obtaining anything but hydrocarbons of Balard. The formation of these was abundant, even with the most highly hydrated acid, and with a very moderate coloration of the fluid.

---

*W. & J. Galloway's Patent Improvements in Steam Boilers.**

In our last number we noticed, briefly, an arrangement of slides for steam engines, lately patented by Messrs. Galloway, in which double ports were employed to afford a better exit of the steam, with other advantages.

We, however, attach a greater importance to Messrs. Galloway's improvements in boilers, which embrace various arrangements of their CONICAL *water tubes.* We believe that boilers on this principle are destined to supersede the ordinary tubular boilers for steam navigation, and if the water tubes in America have not been entirely successful, we attribute it to their not adopting the conical form. We should be glad to see a series of experiments undertaken to prove the relative values of various *kinds of* boiler surface, for we are convinced that a considerable portion

* From the London Artizan, December, 1851.

of the surface of ordinary tubular boilers is inoperative. If we could reduce the cubic contents of our present boilers only 10 per cent., it would be a gain of no ordinary kind; and when we look at the difference between a flue and a tubular boiler, there appears no reason why as great an advance should not again be made. To illustrate the principle, we have sketched one of a set of four marine boilers, arranged so as to have one chimney, common to the four, in the centre. Fig 1 is a side elevation in section; fig. 2 a front view; fig. 3 a plan in section; and fig. 4 an

Fig. 1.

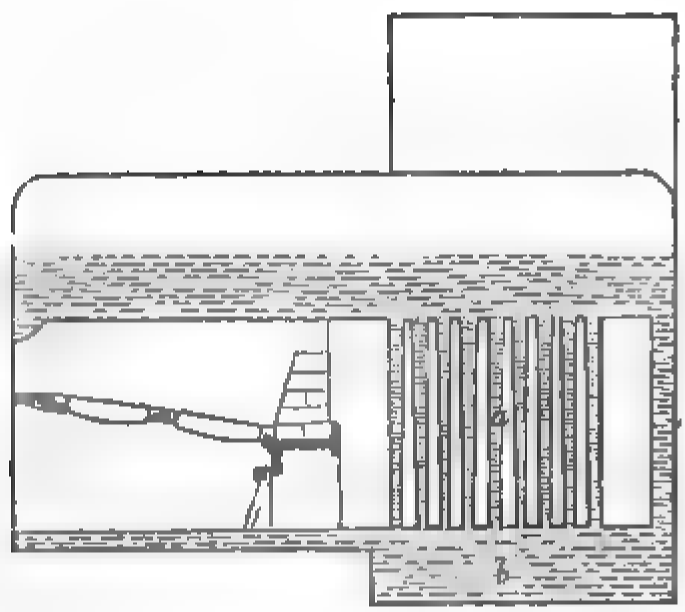


Fig. 2.

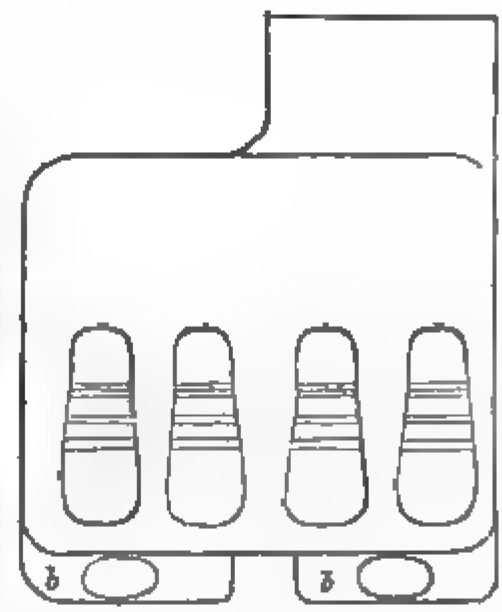


Fig. 3.

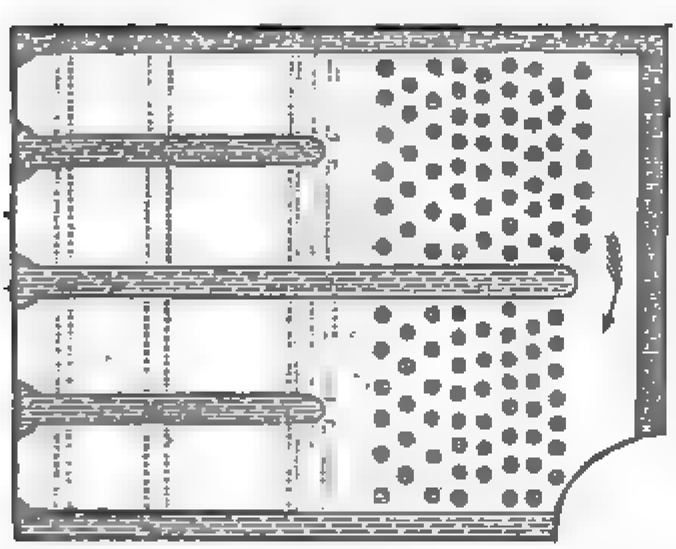
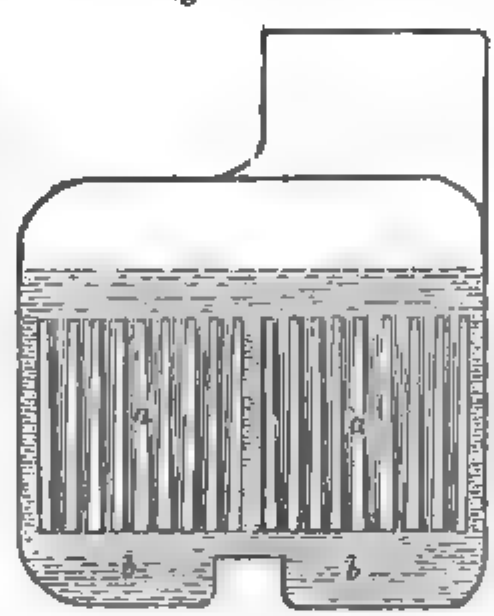


Fig. 4.



end elevation in section across the tubes. The vertical conical tubes, *a*, *a*, are arranged in two rectangular flues behind the furnaces, and are accessible at each end; water spaces of sufficient size, *b*, *b*, being constructed at the bottom, with suitable man-holes. These water spaces drop down between the keelsons, so that the boilers would not occupy any more height than ordinary ones. To return to the question of the value of heating surface. Although this point has never received the attention it deserves, it appears quite rational to suppose that a tube through which a current of water is passing will much more rapidly abstract the heat *from the heated* air which flows over it, than a tube in

which the current is sluggish, or as is the case with ***small, long, cylindrical*** tubes, when they are half filled with steam which cannot freely escape. The conical form provides for these requirements admirably. The inclined position of the sides affords a better surface for the flame to act upon, whilst the bubbles of steam, as they are formed, find room to rise freely. It will be observed that the tubes nearest the furnace are placed farther apart than those behind them. The reason for this is obvious. The progress of the flame is not so abruptly arrested, and the heat is diffused more equally over the whole number of tubes, which materially adds to their durability. We hope to be able to give, on some future occasion, a report on these boilers, a trial of which we await with great interest. Since we described the boilers constructed by Messrs. Galloway for the Gutta Percha Company, several have been erected in and around London; and it is a fact worth noting, that the tubes have proved, after two years' use, as durable as the best boilers of the ordinary form.

On the Lines of Magnetic Force. By Prof. Faraday.*

That beautiful system of power which is made manifest in the magnet, and which appears to be chiefly developed in the two extremities, thence called ordinarily the magnetic poles, is usually rendered evident to us in the case of a particular magnet by the attractive or repulsive effect of these parts on the corresponding parts of another magnet; and these actions have been employed, to indicate both the direction in which the magnetic force is exerted, and also the amount of the force at different distances. Thus, if the attraction be referred to, it may be observed either upon another magnet or upon a piece of soft iron; and the law which results, for effects beyond a certain distance, is, that the force is inversely as the square of the distance. When the distance of the acting bodies from each other is small, then this law does not hold, either for the surface of the magnets or for any given point within them.

Mr. Faraday proposes to employ a new method, founded upon a property of the magnetic forces different from that producing attraction or repulsion, for the purpose of ascertaining the direction, intensity, and amount of these forces, not to the displacement of the former method, but to be used in conjunction with it; and he thinks it may be highly influential in the further development of the nature of this power, inasmuch as the principle of action, though different, is not less magnetic than attraction and repulsion, not less strict, and the results not less definite.

The term line of magnetic force is intended to express simply the direction of the force in any given place, and not any physical idea or notion of the manner in which the force may be there exerted; as by actions at a distance, or pulsations, or waves, or a current, or what not. A line of magnetic force may be defined to be that line which is described by a very small magnetic needle, when it is so moved in either direction correspondent to its length, that the needle is constantly a tangent to the line of motion; or, it is that line along which, if a transverse wire be

* From the London Athenæum, February, 1852.

ved in either direction, there is no tendency to the formation of an ctric current in the wire, whilst if moved in any other direction there such a tendency. The direction of these lines about and between linary magnets is easily represented in a general manner by the well own use of iron filings.

The method of recognising and taking account of these lines of force ich is proposed, and was illustrated by experiments during the eve- g, is to collect and measure the electricity set into motion in the mov- ; transverse wire; a process entirely different in its nature and action that founded on the use of a magnetic needle. That it may be ad- ntageously employed, excellent conductors are required; and therefore se proceeding from the moving wire to the galvanometer were of cop- · 0·2 of an inch in thickness, and as short as was convenient. The vanometer, also, instead of including many hundred convolutions of ong fine wire, consisted only of about 48 or 50 inches of such wire that described above, disposed in two double coils about the atic needle: and that used in the careful research contained only 20 hes in length of a copper bar 0·2 of an inch square. These galvano- ters showed effects 30, 40, or 50 times greater than those constructed th fine wire; so abundant is the quantity of electricity produced by the ersections of the lines of magnetic force, though so low in intensity.

The lines of force already described, will, if observed by iron filings a magnetic needle or otherwise, be found to start off from one end of ar magnet, and after describing curves of different magnitudes through surrounding space, to return to and set on at the other end of the gnet; and these forces being regular, it is evident that if a ring, a le larger than the magnet, be carried from a distance towards the mag- : and over one end until it has arrived at the equatorial part, it will ve intersected once all the external lines of force of that magnet. ch rings were soldered on to fitly shaped conductors connected with galvanometer, and the deflections of the needle observed for one, o, or more such motions or intersections of the lines of force: it was ted that when every precaution was taken, and the results at the gal- nometer carefully observed, the effect there was sensibly proportionate small or moderate arcs to the number of times the loop or ring had ssed over the pole. In this way, not only could the definite actions the intersection wire be observed and established, but also one mag- : could be compared to another: wire of different thickness and of dif- ent substances could be compared; and also the sections described by wire in its journey could be varied. When the wire was the same length, diameter, and substance, no matter what its course was across lines of force, whether direct or oblique, near to or far from the poles the magnet, the result was the same.

A compound bar magnet was so fitted up that it could revolve on its s, and a broad circular copper ring was fixed on it at the middle dis- ce or equator, so as to give a cylindrical exterior at that place. A pper wire being made fast to this ring within, then proceeded to the ddle of the magnet, and afterwards along its axis and out at one end. second wire, touched by a spring contact, the outside of the copper g, and was then continued outwards six inches, after which it rose and

finally turned over the upperpole towards the first wire, and was attached to a cylinder insulated from but moving round it. This cylinder and the wire passing through it were connected with the galvanometer, so that the circuit was complete; but that circuit had its course down the middle of the magnet, then outwards at the equator and back again on the outside, and whilst always perfect, allowed the magnet to be rotated without the external part of the circuit, or the latter without the magnet, or both together.

When the magnet and external wire were revolved together, as one arrangement fixed in its parts, there was no effect at the galvanometer, however long the rotation was continued. When the magnet with the internal wire made four revolutions, as the hand of a watch, the outer conductor being still, the galvanometer needle was deflected 35° or 40° in one direction: when the magnet was still, and the outer wire made four revolutions as the hands of a watch, the galvanometer needle was deflected as much as before in the contrary direction: and in the more careful experiments the amount of deflexion for four revolutions was precisely the same whatever the course of the external wire, either close to or far from the pole of the magnet.

Thus it was shown, that when the magnet and the wire revolved in the same direction, contrary currents of electricity, exactly equal to each other, tended to be produced; and those outside resulted from the intersection by the outer wire of the lines of magnetic force external to the magnet; that wherever this intersection was made the result was the same; and that there were corresponding lines of force within the magnet, exactly equal in force or amount to those without, but in the contrary direction. That in fact every line of magnetic force is a closed curve, which in some part of its course passes through the magnet to which it belongs.

In the foregoing cases the lines of force, belonging as they did to small systems, rapidly varied in intensity according to their distance from the magnet, by what may be called their divergence. The earth, on the contrary, presents us, within the limits of one action at any one time, a field of equal force. The dipping needle indicates the direction or polarity of this force; and if we work in a plane perpendicular to the dip, then the number or amount of the lines of force experimented with will be in proportion to the area which our apparatus may include. Wires were therefore formed into parallelograms, inclosing areas of various extent, as one square foot, or nine square feet, or any other proportion, and being fixed upon axes equidistant from two of the sides, could have these axes adjusted perpendicular to the line of dip and then be revolved. A commutator was employed and associated both with the galvanometer and the parallelograms, so that the upper part of the revolving wire always sent the current induced in it in the same direction. Here it was found that rotation in one direction gave one electric current; that rotation in the reverse direction gave the contrary current; that the effect at the galvanometer was proportionate to the number of rotations with the same rectangular; that with different sized rectangles of the same wire the effect was proportionate to the area of the rectangle, *i. e.*, the number of curves intersected, &c. &c. The vicinity of other magnets to this magnet made no difference in the effect, provided they were not moved during the ex-

periments; and in this manner the non-interference of such magnets with that under investigation was fully established.

All these and other results are more fully stated and proved in papers now before the Royal Society. The general conclusions are, that the magnetic lines of force may be easily recognised and taken account of by the moving wire, both as to direction and intensity, within metals, iron or magnets, as well as in the space around; and that the wire sums up the action of many lines in one result: That the lines of forces will represent the nature, condition, direction, and amount of the magnetic forces; that the effect is directly as the number of lines of force intersected, whether the intersection be direct or oblique; that in a field of equal force, it is directly as the velocity; or as the length of the moving wire; or as the mass of the wire; that the external power of an unchangeable magnet is definite yet illimitable in extent; and that any section of all the lines of force is equal to any other section; that the lines of force within the magnet are equal to those without; and that they are continuous with those without, the lines of force being closed curves.—*Proc. Roy. Inst., Jan.* 23, 1852.

Observations on the Formation of Sulphuric Acid from Sulphurous Acid and Oxygen. By Prof. Wöhler.*

It is well known from the experiments of Dœbereiner, and other chemists, that several metallic oxides are capable, like platinum, of supporting the slow combustion of alcoholic vapor. I considered it highly probable that this action would likewise extend to a mixture of sulphurous acid gas and oxygen, and requested M. Mahla to make some experiments on the subject in such a manner that a dry mixture of about two volumes sulphurous acid and one volume oxygen or of atmospheric air were passed over oxide heated in a glass tube to a faint red.

1. *Oxide of Copper, Peroxide of Iron, Oxide of Chromium,* each separately employed, instantly cause the production of dense white fumes of sulphuric acid. A mixture of oxide of copper and oxide of chrome, prepared by precipitation, had in particular a very powerful action. The same amount of oxide appears capable of converting an unlimited quantity of the gases into sulphuric acid. The formation of sulphuric acid proceeds so readily, and to such an extent, that this process will undoubtedly come to be practically employed.

2. *Oxide of Copper and Oxide of Iron,* heated in sulphurous acid without oxygen, are reduced, the first to red protoxide, the latter to black protoperoxide, with production of vapors of sulphuric acid, but which, however, cease to appear as soon as the reduction is complete.

3. *Oxide of Chromium,* heated without oxygen in sulphurous acid, remains unaltered; not a trace of sulphuric acid is formed.

4. *Metallic Copper,* placed in a spongy state over mercury in a mixture of two volumes sulphurous acid and one volume oxygen, exerts at the ordinary temperature, even in the course of several days, no action upon the mixture of gases. But if the spongy copper be heated in it, fumes

*From the London Chemical Gazette, April, 1852.

of sulphuric acid are formed, but not before the copper has become converted on the surface into oxide.

5. *Caustic Lime*, heated in the gaseous mixture, becomes brightly incandescent, and is converted into sulphate without any formation of free sulphuric acid.

6. *Aqueous Vapor*, passed with the gaseous mixture through a porcelain tube at a faint red heat, does not induce the production of the hydrate of sulphuric acid.

7. *Platinum Foil*, polished and cleansed by treatment with hot sulphuric acid, alkali, and water, acts upon the dry gaseous mixture like spongy platinum; far below red heat, it causes with great readiness, the formation of anhydrous sulphuric acid, without the slightest evident alteration at its surface. It does not act at the ordinary temperature.

M. Mahla has found on this occasion that a mixture of peroxide of iron and oxide of copper, prepared by precipitation, and calcined when heated in a jet of hydrogen, becomes red hot like spongy platinum, and remains incandescent.—*Liebig's Annalen, Feb.* 1852.

For the Journal of the Franklin Institute.

Pacific Mail Steamer Golden Gate.

This vessel is the fastest steamship in the Pacific, and I furnish you with her log for the round trip between Panama and San Francisco; it will be seen that where coal is from $25 to $40 per ton, very great speed cannot be *afforded.*

Length on deck,	265 feet.
Breadth of beam,	40 "
Whole depth of hold,	20 "
Depth of hold for tonnage,	22 "
Tonnage,	2030 tons.
Two Oscillating Engines.	
Diameter of cylinders,	7 feet 1 inch.
Length of stroke,	9 "
Diameter of paddle wheels,	31 "
Length of paddles,	12 "
Depth of paddles,	2 "
Four Iron Tubular Boilers.	
Whole amount of fire surface,	12052 square feet.
Whole amount of grate surface,	367 " "

I will mention here, that her cut-off valve is a double beat or balance valve, and it is used at the same time as a throttle, being connected by a rolling joint on a radius bar; the said bar being worked by a cam on the shaft. It is the same size as the steam valve, (15 inches,) and it will only raise three inches, which is sufficient to use all the steam we can make.

Since she has been on this coast there has not, at any time, been less than four different kinds of coal in her bunkers, and almost all of it of a very inferior quality; some of it having been exposed on the beach for eighteen months or two years; and at other times she has taken the refuse out of four or five different ships.

Annexed is the Steam Log from San Francisco to Panama, and back to San Francisco.

…1852.	…s of …ing.	…m. lbs.	…m. in.	…off. ft.	…off. in.	…tle. in.	…r day.	…r hour.	…e knot.	…er day.	…r hour.	…r day.	…r hour.	…r knot.	…tal. tons.	cent. …hes.	…ft of …ter.		…ip of …eels.		…ration …oilers.	Remarks.
From San Francisco to Panama.																						
Jan. 21	2	10	25	4	6	2½	1532	766	76½	20	10	9200	4600	460		23	15	5	6	10	1¾	Light winds and calms.
" 22	24	10½	25	4	6	2½	18416	768	74¾	246	10¼	105672	4403	430	52¼	23					1¾	
" 23	24	10¾	25	4	6	2½	19023	792	76	250	10½	111112	4630	444	55⅝	26					1¾	Fine weather, light breeze, smooth sea.
" 24	24	11	25	4	6	2½	19503	812	74¾	261	10¾	115282	4803	442	59⅝	28					1¾	
" 25	24	11	25	4	6	2½	20234	844	73⅛	277	11½	126948	5290	458	63¼	36					1¾	
" 26	24	9	25	4	6	2½	20260	844	70½	287	12	137952	5831	480	69⅞	38					1¾	
" 27	24	9	25	4	6	2½	20006	875	69	290	12½	117368	4890	405	58¾	28					1¾	
" 28	20	10½	25	4	6	2½	17672	883	71	249	12½	90576	4528	364	46¼	23	13	0	4	6	1¾	Light winds and calms all these days.
" 29	12	10	25	4	6	2	9065	824	59¾	252	12¾	75344	4432	495	37¾	16	13	7	5	0	1¾	Stopped at Acapulco 16 hours.
" 30	24	12	25	4	6	2½	20575	857	79½	259	10¾	103850	4328	401	56¼	20					1¾	
" 31	24	11½	25	4	6	2½	21065	878	89¾	235	10	114704	4779	489	57½	20					1¾	
Feb. 1	24	11	25	4	6	2½	20995	873	81½	259	10¾	120632	5026	465	60⅓	20					1¾	Strong breeze from eastward.
" 2	24	10½	25	4	6	2½	21460	894	77	280	11¾	120088	5004	429	60	20					1¾	Rain squalls and calms.
" 3	16	10½	25	4	6	2	13184	824	70½	186	11¾	74664	4666	397	37½	21	12	3	3	8	1¾	Strong breeze and tide against us.
From Panama to San Francisco.																						
Feb. 12	6	12	25	4	6	2½	6280	785	89¾	70	8¾	54536	6817	779	27¼	19	15	11	7	4	1¾	Light wind, sail set running down bay, 90 miles.
" 13	24	11½	25	4	6	2½	18215	759	85½	213	8¾	130532	5438	614	65¼	10					1¾	Light head winds.
" 14	24	11¾	25	4	6	2½	18830	784	79½	238	10	122944	5122	516	61½	20					1¾	
" 15	24	11¾	25	4	6	2½	19020	792	79¾	274	11½	116280	4845	425	58¼	19					1¾	Strong breeze and rough head sea.
" 16	24	11	25	4	6	2	18725	780	74¼	252	10½	128754	5364	511	64⅝	21					1¾	
" 17	24	10½	25	4	6	2½	19130	797	77¾	246	10¼	123646	5151	503	61¼	22					1¾	Moderate breezes and head sea.
" 18	13½	11¾	25	4	6	2	11367	844	74½	153	11¼	61855	4418	404	31⅞	22					1¾	Fine weather and calms; stopped at Acapulco 25½ hours.
" 19	9	10½	25	4	6	2½	6391	710	66¾	96	10⅝	50874	5653	530	25⅝	21					1¾	
" 20	24	11	25	4	6	2½	19680	820	77¼	254	10½	120640	5026	475	60¼	20					1¾	Fine weather and calms.
" 21	24	11¼	25	4	6	2½	20385	849	80¼	254	10½	123666	5152	487	61¼	20					1¾	
" 22	24	11¾	25	4	6	2½	20555	856	79¾	258	10¾	127424	5309	494	63¾	20					1¾	Strong breeze and head sea.
" 23	24	11½	25	4	6	2½	20670	861	80¼	258	10¾	115092	4795	444	57½	20					1¾	Light head winds and fine weather.
" 24	24	10¾	25	4	6	2	20687	862	78¼	264	11	113729	4738	431	56¾	20					1¾	
" 25	24	11	25	4	6	1¾	21238	885	80½	264	11	112342	4680	425	58¼	21					1¾	Strong breeze and head sea.
" 26	17½	10	25	4	6	1½	16384	880	80½	192	11	78257	4476	408	39¼	21	12	00	3	6	1¾	

10*

For the Journal of the Franklin Institute.

List of the Engineer Corps of the U. S. Navy.

Chief Engineers.

Charles H. Haswell,
William P. Williamson,
William Sewell, Jr.,
William W. W. Wood,
Henry Hunt,
Daniel B. Martin,
Joshua Follansbee,
Benjamin F. Isherwood,
Jesse Gay,
Samuel Archbold,
George Sewell.

First Assistants.

Nailor C. Davis,
Wm. Everett,*
Wm. H. Shock,*
James W. King,*
Michael Quin,
Geo. F. Hebard,
Wm. K. Hall,
John P. Whipple,
Elbridge Lawton,
Henry Mason,
James G. Young,
John Alexander,
Jesse S. Rutherford,
Robert Danby,
Wm. Holland,
Benjamin F. Garvin,
E. A. Whipple,
Theodore Zeller,
Thomas Kilpatrick,
Henry H. Steward,

* Passed as Chief Engineers but not yet Commissioned.

Second Assistants.

Charles W. Geddes,
John W. Parks,
Nathaniel Patterson,
Robert H. Long,
Alban Stimers,
Thomas A. Stephens,
John Farm,
F. C. Dade,
Geo. T. W. Logan,
E. S. DeLuce,
Harman Newell,
Montgomery Fletcher,
George Gideon,
Edward Fithian,
Wm. C. Wheeler,
D. B. Macomb,
Eli Crosby,
Andrew Lawton,
Wm. H. King,
Richard C. Potts,
J. C. E. Lawrence,
J. M. Maury,
James M. Adams,
Simon B. Knox,
Amos Broadnix,
Wm. A Latimer,
Jackson R. Hatcher,
James M. Hobby,
Daniel T. Mapes,
James H. Warner,
Washington H. Nones,
William H. Rutherford,

Third Assistants.

Geo. W. Alexander,
Thomas A. Jackson,
T. A. Shock,
Wm. J. Lamdin,
Charles H. Loring,
William S. Stamm,
H. S. Barker,
S. H. Houston,
C. W. Lee,
S. E. McElroy,
G. F. Barton,
Oscar Davids,
Alexander Henderson,
T. B. C. Stump,
C. H. Mannson,
C. T. Parke,
Virginus Freeman,
George E. DeLuce,
S. D. Hibbert.
J. R. Pomeroy,
P. H. Taylor,
George Johnson,
M. Kellog,
J. C. Hull,
J. C. Mitchell,
Wm. Gorton,
H. Fauth,
E. Robie,
H. Haines,
H. C. Jewell,
Wm. B. Brooks,
Samuel C. Sherry,
L. Arnold,
L. A. Williamson,
H. W. Spooner,
G. E. Shock,
J. D. Mercer,
J. M. Freeman.

Chief Engineers,	11
First Assistants,	20
Second Assistants,	32
Third Assistants,	38
Total,	101

For the Journal of the Franklin Institute.

The Collins Steamships.

In a recent number of the *Journal*, I had occasion, in replying to an article by *Britannicus*, (published in the *London Builder*, Oct., 1851,) to deny that the engines, boilers, &c., of the Collins steamers were in any way designed by English Engineers, and that whatever merit they might have, it was our own. The attention of Mr. James Brown, President of the Collins Line, having been drawn to the article before alluded to, he

addressed a note to Messrs. Stillman, Allen & Co., of the Novelty Works, New York, on the subject, and received the following reply:—

"James Brown, Esq.—Dear Sir: We enclose the piece cut from *Galignani's Messenger.* It is quoted from the *London Builder*, and it is strange, indeed, that misrepresentations so utterly without any foundation, should find a place in any journal of any respectability.

"The writer states, as *'from undoubted authority, and as regards some particulars from his own knowledge,' that 'the contractors of the American Line obtained permission from the proprietors of the Cunard Line, to take mouldings or castings of every part, even to the minutest particular, of the engines constructed by Napier, of Glasgow, on board the largest of their vessels.'*

"It does not seem to have occurred to the author of this remarkable assertion, whether it was very probable that the proprietors of the Cunard Line would feel disposed to render any such aid to a rival company, nor does he explain by what mechanical process, the ignorant Yankees were able 'to take mouldings or castings of every part, even to the minutest details of engines' on board of a vessel.

"How utterly without foundation this assertion is, any may see, who will barely look at the two sets of engines; even a casual glance is enough to show their utter dissimilarity throughout, in plan, and in detail; not one piece of one is like one piece of the other; on this point, the engines speak for themselves. They differ about as much as two sets of side lever engines can differ.

"But according to this writer, the possession of all the mouldings or castings was not enough, and, therefore, (he goes on to say,) 'in order that nothing might be wanting to make the engines equal to those in the Cunard steamers, the contractors imported men from the manufactories on the Clyde, for the purpose of making engines in New York.'

"A few facts will show the grossness of this misrepresentation, and exhibit the purely American character of the engines we built for your company.

"Of the proprietors of our concern, every one is a native of the United States, and acquired here whatever mechanical skill or knowledge he possesses.

"Of our foremen, every man (with one exception) was born in the United States, learned his trade in this country, and whatever they have done, in connexion with marine engines, has been at our works. The one exception referred to has been employed at our works for the last 19 years, and never did any work for marine engines in any other place.

"The draftsmen who made the drawings are our pupils, and acquired all the knowledge and experience they have in connexion with steam engines, in our drawing room. The men who superintended the setting of the engines are also natives of the United States, were once our apprentices, and acquired at our works whatever skill and experience they have.

"No man was ever imported from the manufactories of the Clyde, or from any other quarter, with reference to these engines, and neither in the preparation of the plans, nor in the construction of the work, did we ever receive any assistance, direct or indirect, from any engineer on the banks of the Clyde, or from any other part of Great Britain.

"In short, the engines were made of American iron, forged, or melted with American coal; they were planned by American heads, and put together by American hands. In plan, and many important features, they differ, not merely from the Cunard engines, but also from any ever built on the other side of the Atlantic, and we are happy to find that their excellence is so far acknowledged, as to render our English friends anxious to claim the credit of having produced them. Respectfully, yours,

STILLMAN, ALLEN & CO.

"*Novelty Iron Works, New York, Dec.* 23, 1851."

On an Improved Boiler for Marine Engines. By MR. ANDREW LAMB, of Southampton.*

The Peninsular and Oriental steamship *Ripon* is an iron vessel, of 1650 tons burthen, and has two oscillating engines, of 450 nominal horse power. She was built by Messrs. Wigram, in 1846, and was supplied with her machinery by Miller, Ravenhill & Co., of London, since which time she has been almost constantly running for the conveyance of the Indian Mail from Southampton to Alexandria.

Her average speed for the whole of this time has been 9·1 knots per hour. The boilers fitted to her by Messrs. Miller were of the ordinary tubular construction. They were in six pieces, had twelve furnaces, and 744 iron tubes, 3¼ inches outside diameter, 6 feet 6 inches long. The total fire-bar surface was 212 square feet, and the heating surface in tubes 3798 square feet, reckoning the whole of the inside surface of the tubes as effective.

The sectional area through tubes equals 36½ square feet; ditto through ferules, 28 square feet. These boilers were loaded to 10 lbs. on the square inch, but in consequence of being deficient in steam, the actual pressure attained at sea very seldom exceeded 4 to 6 lbs. when full steam was admitted to the cylinders; of course, the engineers found it to their advantage to keep it up to its full pressure by working the expansion apparatus. This deficiency of steam was found to be an increasing evil, the cause for which may be satisfactorily explained by a little consideration of the *modus operandi* of the sea-going tubular boiler. When commencing running with the boilers new, for a short period, dependent on the species of coal consumed, the tubular boiler offers its greatest advantage, and is, in fact, when properly constructed, as good an apparatus for evaporating water as can be imagined applicable to marine purposes. The tubes give an immense amount of heating surface, and in small compass, and from their form are capable of resisting great pressure, but after three or four days' steaming, these advantages diminish. The tubes have an accumulation of soot and light ashes inside them, which, by reducing their sectional area, sometimes from 50 to 75 per cent., diminishes the draft through the furnaces in the same proportion, and also reduces the effective heating surface to the same serious extent. This accumulation depends in quantity very much upon the coal. On one occasion the author was present in a vessel with tubular boilers, burning Scotch coal,

* From the London Artizan, March, 1852.

and they actually came to a dead stand, after only sixty hours' steaming, the tubes being nearly choked up, and requiring to be swept. When tubular boilers have made a few voyages at sea, the outside of the tubes becomes encrusted with saline matter, which gradually accumulates upon them, chiefly upon their bottom sides, and which hitherto it has been found impossible to remove by any other means than scaling them mechanically. The situation of the tubes (row over row) prevents this being accomplished, excepting upon the upper tiers, and the consequences are, that the tubes become coated with a crust $\frac{1}{4}$ or $\frac{3}{8}$ths of an inch thick, and the tube-plates also, which from its non-conducting nature greatly retards the transmission of the heat through it, and the tube plates becoming hot, crack and blister, and deteriorate very rapidly.

For the boiler to be described in the present paper, invented and patented by the author in conjunction with Mr. Summers, the following advantages are claimed over its tubular competitor:—

1st, That, while it possesses an equal amount of heating surface in the same space as tubular boilers, it is free from the evil of choking with inside deposits of soot and ashes, because the flues being in one sheet for their whole depth, the deposit falls into the bottom of the flues, and is swept by the draft through into the up-take, and thence into the chimney.

The flues are flat rectangular chambers, 6 feet 9 inches long, and 3 feet 3 inches high, open at each end, where they are fixed to the boiler. There are seven of these flues to each fire grate; the smoke spaces are $1\frac{3}{4}$ inches wide, and the water spaces $2\frac{5}{8}$ inches. The sides of the flues are $\frac{1}{4}$-inch thick, and they are supported by stays, fixed inside the flues. From this circumstance of there being no stays or other projections in the water spaces, an important advantage is gained—that no nucleus is offered round which the scale can collect, and no impediment to interfere with the complete and rapid cleansing of the water spaces from scale by means of the ordinary scrapers.

In another arrangement of these boilers, adapted for large screw steamers, and also for war steamers, the flues are placed alongside the furnaces and at the same level, instead of over the furnaces, as in the engravings, which arrangement protects the boilers from shot, by keeping them below the water line.

In these improved boilers, the same amount of heating surface can be obtained in the same capacity of boiler as with tubes; the only difference is, that if the tubes are $\frac{3}{16}$ths of an inch thick, they will of course be rather lighter than $\frac{1}{4}$-inch plates; but this difference, as compared with the gross weight, is so small as to be unimportant. In the event of any accident to any of the flues, they may be taken out, separately or collectively, to be repaired or replaced with new ones; but from the facility with which they can be kept clean, they ought, as in the old-fashioned flue boilers, to wear out the shell; the length of time being remarkable that a *thin* plate will last, if kept clean, and never overheated.

The last boilers of this construction examined by the author were those of the *Tagus*, 280 horse power, and in those boilers, after six days' steaming, the deposit was only three inches deep in the bottom of each flue;

and the total depth of the flues being 3 feet 8 inches, it follows that she had only thus lost about 6 per cent. of sectional area.

2d, That the improved flues, from having no projection either of rivet heads or stays in the water spaces, offer no obstructions whatever to the scaling tool, and are as easily kept clean as any part of any boiler can possibly be, thereby entirely removing the evil of a loss of heat through non-conducting deposits, and very much increasing the durability of the boiler.

3d, That the water spaces between the flues being comparatively large, and the sides of the flues perfectly vertical, the circulation of water in the boiler must necessarily be much more perfect than amongst a number of tubes, (amounting sometimes to thousands,) where the water has to wend its way in and out in curved lines. This greater perfection of circulation, the author thinks, must add greatly to the effectiveness of the heating surface in the improved flues.

It must be here mentioned, that these advantages do not now rest upon theory only, and that they have been fully realized by experience.

The first boilers fitted with these flues were those in the *Pacha*, in October, 1849, similar to those shown in the engravings, and up to the time of her unfortunate loss, these boilers gave entire satisfaction. Then followed a small boat, in January, 1850, and the *Tagus*, in August, 1850, since which their success has been rapid, as a proof of which, numerous vessels of different companies are being and have been fitted with them. The *Tagus* has now the oldest of the boilers, and there is in no part of them any signs of deterioration whatever; in fact, they are in every way perfect. There has never been any leakage, and the consumption of fuel is less than with her former tubular boilers.

The improved boilers now fitted to the *Ripon* were manufactured by Messrs. Summers, Day, and Baldock, of Southampton, and are in four parts, the boilers being placed in the wings, two forward of the engines, and two aft; the stoke-holes are thus in midships.

The space occupied by these new boilers is the same as the old ones, the arrangement mentioned having economized as much room as the increased size of boilers required, so that the same quantity of coal is carried in the same space as before. The new boilers have 16 furnaces and 246 square feet of fire-bar surface; 112 flues, 3 feet 9 inches deep × 6 feet 3 inches long, being 5440 square feet of heating surface, reckoning the whole inside surface (as in tubes); the sectional area through the flues, deducting the stays, = 54 square feet.

This large sectional area can be diminished at pleasure by a grating damper, which is hung at the front end of the flues, and extends about 10 or 12 inches down them, and which is worked by handles placed outside the boiler, and between the hinges of the smoke-box doors. The engineer can thus regulate the intensity of his draft at pleasure, according to the variety of the coal in use, &c., &c.

The new boilers of the *Ripon* are loaded to 13 lbs. per square inch; the flues being strongly stayed inside, would of course resist a far higher pressure with perfect safety; in fact, if required, they might easily be sufficiently stayed to resist steam of any pressure.

The *Ripon*, at the same time that the boilers were altered, had her com-

on radial paddle wheels replaced by feathering ones, which consequently ldded much to the speed of the vessel.

The best speed of the engines of the *Ripon*, with the old arrangement, as about 15 revolutions per minute, and that of the vessel about 10 nots per hour, when quite light.

On the trial at the measured mile, December, 1851, the vessel was rawing 16 feet 3 inches forward, and 16 feet 7 inches aft; she had all er coal (422 tons) on board, her water, and some cargo, and consequently 'as pretty deep loaded. The speed of the engines was 19½ revolutions er minute, and of the vessel 11·3 knots per hour. Had she been light, s in the former trial, she would have probably gone over 12 knots. It ppears, therefore, that the improvement in speed may be fairly stated as wo knots per hour. The cylinders of the engines are 76 inches diameter < 7 feet stroke. Their nominal horse power formerly, at 15 revolutions, rould be 404, and at 19½ revolutions, 526 horse power; so that the new oilers have given 122 horse power more steam, of an increased pressure f 3 lbs. per square inch, than the old ones. As the *Ripon* is now making er first voyage with the new boilers, the author cannot speak with any ertainty about her consumption, but will give some details of the Pennsular and Oriental steam ship, *Bentinck*, which has made one voyage o Alexandria and back, with these improved boilers and feathering wheels.

The *Bentinck* is a wooden vessel, built by Wilson, of Liverpool, in .844, and has side lever engines, by Fawcett and Preston. She is 2020 ons burthen, and her engines are 520 nominal horse power; her origiial boilers were of the old flue construction, and were loaded to 6 lbs. er inch pressure; her average speed at sea was 9 knots per hour, and her engines about 14 revolutions per minute.

The speed of the *Bentinck* is now over 11 knots per hour. The former consumption was about 37 cwt. per hour; the present consumption aveages about 38 cwt. per hour.

It must be noticed that the Peninsular and Oriental Company had tubular boilers, with brass tubes, made for this vessel by Messrs. Bury, Curtis, and Kennedy, and that they were brought to Southampton, and placed in the *Pottinger*, a sister ship of the *Ripon*, and of 450 nominal horse power, with common paddle wheels; these boilers are of exactly the same size as the patent boilers made for the *Bentinck*, and they are both loaded to the same pressure, viz: 12 lbs. per square inch; they have each made a passage to Alexandria and back, and, contrary to all expectation, the *Bentinck*, although her engines are 70 horse power nominal more than the *Pottinger*, and are working up to 103 horse power more, has consumed 128 tons less coal than the *Pottinger*, and performed the same distance in 68½ hours less time. This result of diminished consumption is undeniably a fair triumph for the improved boiler; as for the improved speed of the vessel, it must share the honors with the feathering paddle wheel; the *Bentinck* has made the fastest passage on record between the ports mentioned.

In conclusion, the author can only say, that he believes the improved boiler, described in the present paper, will become the marine boiler generally adopted; as its merits are evident, and its cost is not greater

than tubular boilers; while its durability will, he thinks, be very much greater. He will be happy to show these boilers to any of the members of the institution who may have an opportunity of seeing those that may be in port, or at Mr. Summers' works at Southampton, where there are now five sets in course of construction. It may be added, that the screw steam ship *Glasgow*, by Messrs. Todd and McGregor, which has lately made the fastest run across the Atlantic of any screw steamer, is fitted with these improved boilers; Messrs. Todd and McGregor have made a considerable number of them, and they are also being manufactured by several others. It is intended also to adopt these boilers in the *Himalayah*, now building for the Peninsular and Oriental Company, of upwards of 3000 tons burthen, to be propelled by oscillating engines of 1200 horse power.

Fig. 1.

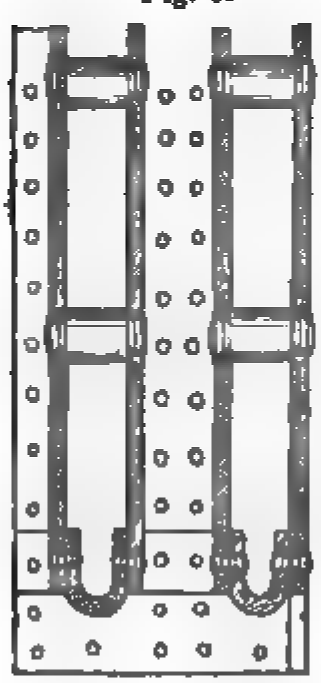


Fig. 2.

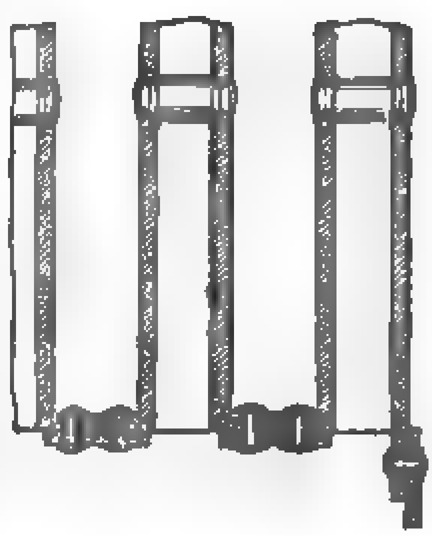
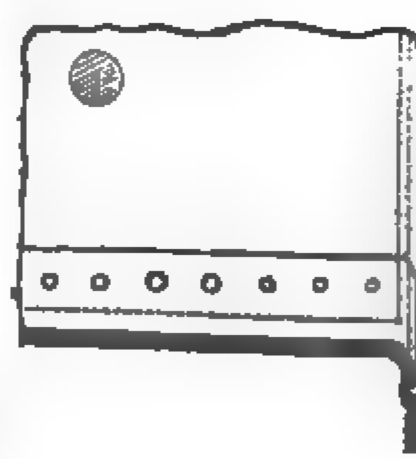


Fig. 3.



The details of construction of the flues are shown in figs. 1, 2, and 3; fig. 1 is a transverse section, fig. 2 a plan, and fig. 3 a longitudinal section of a portion of the flues shown on an enlarged scale. They are constructed of two flat side plates, $\frac{1}{4}$-inch thick, flanched outwards at each end, to meet the plates of the adjoining flues; the top and bottom of each flue is formed by the curved connecting piece, which is riveted to each side plate, and flanched outwards at the ends. The stays or studs are $1\frac{1}{4}$ inch diameter, and are riveted at each end through the side plates. The rivets connecting the plates together, and the stays, are all put into their holes simultaneously, and riveted cold by machinery. These rivets have countersunk heads and points, and when placed in their holes in the plates, a steel bar is inserted, which fills up the space between the heads of the two rows of rivets, and acts as a bolster to the riveting tool. By this means, one stroke of the machine closes two rivets at once, and in the most efficient manner. The flues are afterwards riveted together with covering strips, at their ends, and they are inserted into the boiler in sets of seven or eight, according to the size of the furnace.

Any one of the flues can be readily extracted from the others, if necessary, by cutting away the two rows of rivets at each end, and drawing it out through the front smoke-box doors. The experience which they have

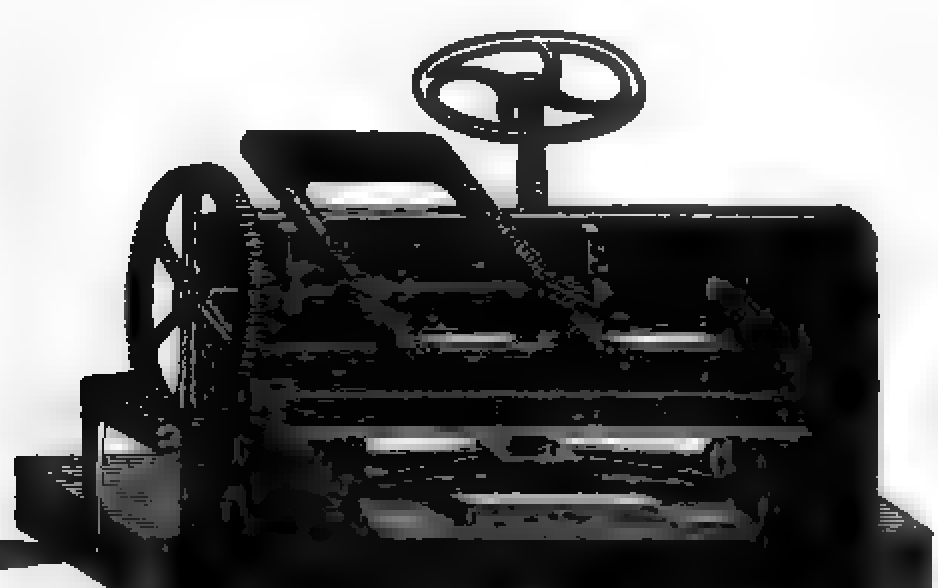
had of the durability of the flues has, however, satisfied those who have employed them, that unless gross negligence of the engineer should (through want of water) allow them to get red hot, the flues will in all cases outlive the shells in which they are inserted. Drawings of the boilers will be found in the *Artizan* for December, 1850.—*Proc. Inst. Mech. Eng.*

The improved steam boiler of Lamb and Sumner has been secured by patent in this country, and is being used by the Navy Department on board the steamers *Princeton* and *Alleghany.*

---

*Engraved Photographs—Bottier's Paper Cutting Machine—Colt's Revolver.**

It is now some time since we threw out an idea as to the prospective advantages of bringing the photographic process into more immediate connexion with the engraver's art, and pointed to the more than probable chance of fitting it for the part of the engraver's draftsman, in actually pencilling out the lines for the wood graver, the etching needle, or the burin. Considered in relation to engraving directly through the photographs themselves on copper plates, for the purpose of producing large plate engravings, such as are to be found interspersed throughout our own pages, we have, so far, seen no reason for a change of opinion upon the practical difficulties surrounding the project. We have, however, more especially contemplated its fitness for the smaller and otherwise more manageable work of the wood-engraver; and we can now point to the engraving which illustrates this article, as being a further illustration of the soundness of our earlier views.



[Engraved from a Collodion Film transferred to the wood.]

We may be wrong, and we are ready and willing to be set right if we are so, but we believe the annexed engraving of "M. Bottier's Paper Cutting Machine" to be the first published example of this branch of the economics of the atelier. We believe it to be the first engraving which

*From the London Practical Mechanic's Journal, May, 1852.

has been produced after the "pencillings of light." Our first theoretical notion, seeing the then apparent impossibility of engraving an actual daguerreotype plate, was to take the photographic picture on tissue paper, and lay this down on the plate or wood block, and engrave the design through it. Then we hit upon the plan of silverizing the wood block, placing it in the camera for the image, and finally engraving it direct. This project has not yet been realized, although the recent discovery of albumenized and collodionized glass has brought us within one stage of its accomplishment. At our suggestion, Mr. Urie, the artist to whom has been intrusted the execution of the whole of the wood engravings given in this *Journal*, turned his attention to these views of the subject. After long and careful experiments, he seized upon the collodion system as best suited for his purpose, and his success with it is best evidenced in the perspective figure of the machine to which we have already referred.

After obtaining the picture upon the collodion coating in the usual manner, he detaches the thin collodion film from its glass base, and lays it on the prepared wood block, just as we had previously proposed to do with the paper image. The engraver then engraves through the film, as if he were treating an actual drawing upon the wood surface.

It is obvious that the whole process, more especially the transfer of the pictorial film from its original foundation to the block, is a matter involving excessive nicety of manipulation. The operator proceeds by floating off the film in water, by placing the glass plate horizontally therein, and with the picture upwards, assisting the dislodgment of the film, when necessary, by slight mechanical action. Then, the wood block having its surface previously prepared with white of egg and lamp-black—the darkening being necessary to throw out the picture from its translucent ground—the film is carefully laid upon the block; the white of egg having sufficient adhesive power to hold it firmly down. At first, the very obvious difficulty of the peeling off, or disintegration of the film, opposed the efforts of the engraver in his subsequent treatment of the block; but the brittleness has been overcome by a slight wash of varnish.

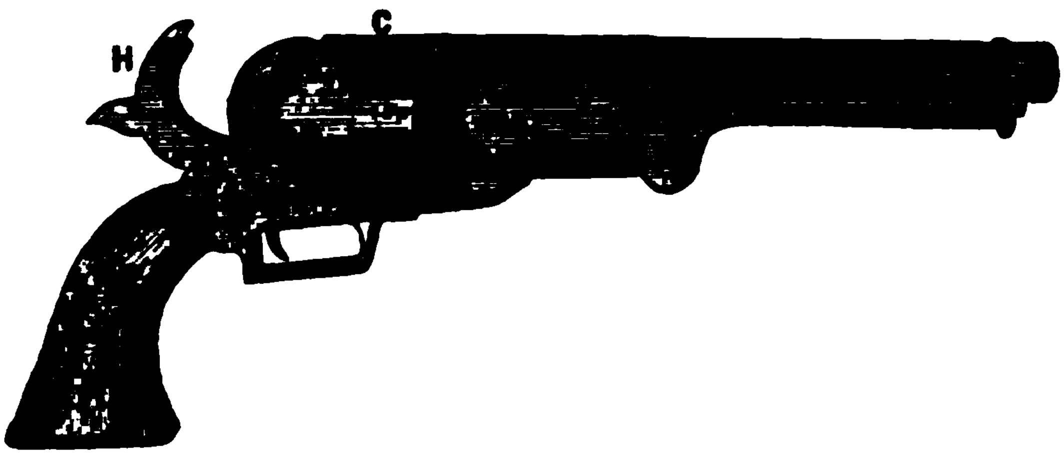
Engravings produced in this way are light drawn pictures indeed. In his execution of them, the engraver is freed from the mannerisms or imperfections of the artist or mechanical draftsman, escaping, on the one hand, the dangers of the lack of "life," or the missing of expression; and, on the other, avoiding all inconvenience from chance, error, or neglect.

We are now more than ever inclined to think that the time is approaching when the engraver may produce his own "sun pictures" of all external views of existing objects, directly on his blocks—reducing or enlarging his scale with all imaginable facility and accuracy. What we have shown is a great step towards this end—of *its* powers of faithful rendering, our readers may satisfy themselves, by consulting *Le Genie Industriel*, for a comparison of our reduced figure, with M. Bottier's original drawing.

In the interval of writing and printing the present paper, Mr. Urie has succeeded in making daylight his "draftsman" on the wood. The little figure of Colt's "revolver," or "repeating pistol," given below, has been *reduced* directly on the wood, in the camera, from a larger sketch of Col.

Colt's. The history of the operator's course of procedure may be summed up in few words. He first tried a coating of ordinary printer's ink for the blackened coating of the wood, varnishing this over with white wax, which was finally covered with the collodion film. This was a failure, from the mingling of the collodion with the wax, and the camera produced an image which shortly left a mere white ground. The difficulty now was, how to procure a good intermediate varnish, and mastic, shellac, and copal, were all successively tried and laid aside. Then, in retracing the process, the printers' ink was discarded, and a mixture of lamp-black and white of egg substituted as the ground, with a naphtha solution of gutta percha as a varnish beneath the collodion.

But the best results have been obtained by drying on a coating of lampblack and white of egg, and varnishing this over with a coat of pure white of egg alone before laying on the collodion. The accompanying sketch of the pistol was so produced. After collodionizing the wood, it is dipped into nitrate of silver, and placed at once in the camera,



[Engraved from a Collodion Photograph taken directly on the wood.]

the picture being subsequently developed by dipping in sulphate of iron and nitric acid, washed in pure water, and finally fixed with hypo-sulphite of soda, just as in the process given by our correspondent, "H. R." at page 209 of our 4th volume. To preserve the picture, a final coat of mastic varnish is laid on.

Translated for the Journal of the Franklin Institute.

Note on the Crystals contained in Glass. By M. Leydolt, of Vienna.

I have been for some time employing myself in the crystallographic study of the silicates; and in this way have been led to submit them to the action of fluorhydric acid, for the purpose, especially, of distinguishing the constituent parts of the compound minerals, such as the agates. The crystallized quartz remaining untouched, forms prominences on the plane of the agate, so that after copying this design in relief, by means of galvano-plastic processes, we may take impressions, which are true etchings, and which give, with an exactness which the graver could never reach, all the so varied, and often so complicated interior conformation of the agates.

In proceeding in the same way with glass, I was astonished to see that glass is not a homogeneous substance, whatever may be its chemical composition; all the glasses which I have been able to procure, contain a

greater or less number of perfectly distinct, regular, and transparent crystals, which are imbedded in the amorphous material; to make them visible, it is only necessary to submit a slip of glass to the action of hydrofluoric acid gas, mixed with vapors of water. The operation is stopped the moment the crystals are uncovered by the dissolving of the surrounding amorphous part, which is generally more soluble than they, and the figures thus obtained, may be reproduced by the galvano-plastic processes.

The operation presents no difficulty; it is only necessary to place the slip of glass, on a certain inclination, in the mixture of sulphuric acid and fluor spar, which is used to produce the fluorhydric acid, so that one part of the slip may be plunged in the liquid, and the other be without it; the crystals then become visible above the line of separation, upon that face of the slip which is turned towards the liquid. These crystals also appear on the inner surface of bottles in which very weak fluorhydric acid has been kept, but they are then accompanied by broken lines and concentric circles analogous to those of agate.

These crystals may be followed in the different phases of their formation by means of the slags of smelting furnaces, and I have in this way been able to persuade myself that their number and their development depend essentially on the manner of annealing, and the greater or less rapidity of cooling of the mass.

There are also natural crystals perfectly formed, pure and transparent, which present the same defects of homogeneousness as glass, when they are submitted to the action of different solvents. This is a new subject of study with which I am at the present time employed.—*Comptes Rendus de l'Academie des Sciences, (Paris,) 12th April,* 1852.

Translated for the Journal of the Franklin Institute.

Note on the Incrustations in Steam Boilers. By M. Delandre.

With well or spring waters, the evaporation produces the precipitation of the earthy salts, and gives rise to the incrustations which become so adherent to the wall of the boilers and the tubes that they cannot be detached. When nevertheless it is desirable to continue to use the boilers, a less quantity of steam is generated with a greater expense of fuel, and often the metal becomes softened in the parts where the incrustations are the thickest and nearest the fire, thus occasioning cracks and finally explosions.

To obviate the destruction and dangers in the use of steam, caused by the incrustations, the aggregation of the earthy and calcareous salts must be prevented, by making them soluble in place of insoluble as they were.

Now the protochloride of tin, under the influence of water, is converted into an insoluble basic subsalt, and a soluble acid salt, which dissolves the earthy salts.

After having undergone, for a long time, great annoyances in the use of tubular boilers, in spite of the use of known preservatives, I have for a year past obtained the perfect protection of these generators from incrustations, by placing 4 kilogrammes (8 lbs.) of protochloride of tin in a

boiler which works 12 hours every day, at a pressure of 3 atmospheres, and consumes in that space of time from 1500 to 1600 litres (400 galls.) of water, and is only emptied and refilled once a week.

For steam boilers which are emptied every day, and are of great power, the consumption of the protochloride of tin should be calculated at 1 kil. (2 lbs.) per cubic metre (35¼ cub. feet).

My tubes, stop cocks, and machines, which were also finally covered with incrustations, have been kept in the most perfect state of cleanliness.—*Comptes Rendus de l'Academie des Sciences,* (*de Paris,*) *29th March,* 1852.

On a Continuous Expansion Steam Engine. By Mr. James Samuel, of London.*

The economy of working steam expansively is well known, but the application of the expansion principle is practicable only to a limited extent in most forms of engine, from practical difficulties in their mode of working, which prevent the attainment of the full economy of which the expansive principle is capable.

The greatest useful effect is obtained from the steam, when it is allowed to expand in the cylinder until its pressure upon the piston just balances all the useless resistances of the friction of the engine itself, and the resisting pressure on the back of the piston, (whether the pressure of the atmosphere, in a high pressure engine, or of the uncondensed vapor, in a condensing engine,) the surplus power beyond these useless resistances being alone available for the purposes to which the engine is applied.

But in driving machinery, so great a uniformity of motion is essential, that any great variation in the moving power throughout the stroke of the engine is inadmissible, as the fly-wheel would not be able to absorb enough of the excess of power to equalize the velocity sufficiently, by giving it out again at the deficient part of the stroke; consequently, though two engines are often employed working at right angles to each other, for the purpose of diminishing the variation in total moving power, the expansion principle can only be carried to a portion of the extent to which it is theoretically applicable.

Only in such engines as the large Cornish pumping engines can the expansion be carried practically to its full theoretical limit, as the variation in the velocity of the load moved is of much less importance in those engines, and the very unequal amounts of moving power that are developed in equal times, by the full carrying out of the expansive principle, which would produce the most prejudicial and inadmissible variations of velocity in the engine, are controlled within prescribed limits by the great weight of material to be moved by the engine in the pump rods and balancing machinery, forming, as it were, a distributing reservoir for the moving force developed.

In the locomotive engine there are practical difficulties in carrying out the expansion principle efficiently, beyond a moderate extent, in a single cylinder, from the shortness of stroke, and rapidity of reciprocation, and

* From the London Artizan, for March, 1852.

the construction of the valve motion; but the ultimate extent to which it could be carried would be limited by the maintenance of the blast, which requires that the jets of steam discharged from the cylinder into the blast pipe, should not be reduced below a certain pressure at the moment of discharge. Otherwise, the limit to which expansion might be carried would be the resistance of the atmosphere to the discharge of the steam, added to the friction of the engine, say above 10 lbs. per inch above the atmosphere.

The steam is cut off usually by the link motion at from one-third to two-thirds of the stroke, and the steam is consequently discharged into the blast-pipe at about from 30 to 60 lbs. pressure above the atmosphere, supposing it to be supplied to the cylinders at 100 lbs. per inch above the atmosphere.

It appears that the lower of these pressures is sufficient, or more than sufficient for the purposes of the blast, to maintain fully the evaporative power of the boiler under general circumstances, and that a portion of the steam discharged can be spared from the blast, to be subjected to a greater extent of expansion.

In the continuous expansion engine, the subject of the present paper, the steam from the boiler is supplied only to one cylinder; a portion of it is expanded into the second cylinder, which is of proportionately larger area, so as to equalize the total moving power of the two cylinders; and it is there further expanded down to the fullest useful extent, and then discharged into the atmosphere, the portion of steam remaining in the first cylinder being discharged as a blast at nearly the same pressure as the ordinary engines. The economy, therefore, consists in obtaining from such portion of the steam as can be spared from the blast, the additional power of expansion remaining in it, which is thrown away in the ordinary engine.

Fig. 1.

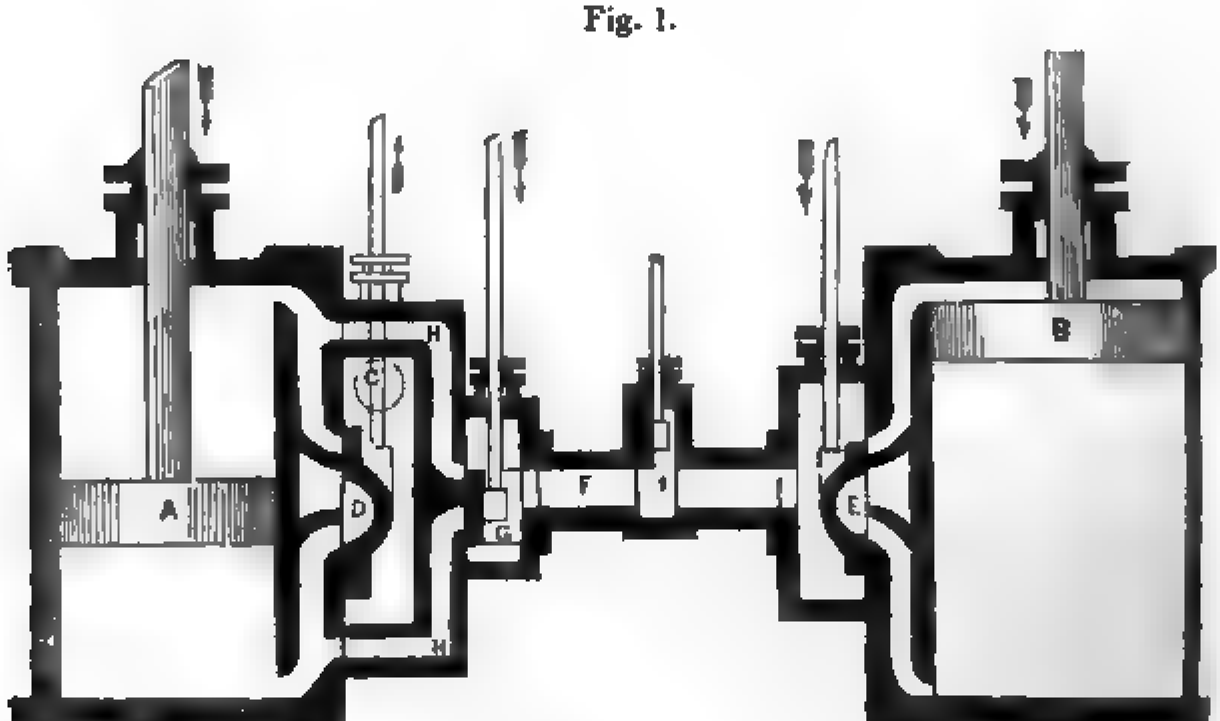


Fig. 1, shows the continuous expansion engine, as applied to a locomotive. A is the first cylinder into which the steam is admitted from the steam pipe, C, by the valve, D, in the same manner as in the ordinary

engines. The steam is cut off at half stroke, and a communication is then opened with a second cylinder, B, through the passages, H and F, by the opening of the slide valve, G. The second cylinder, B, is about double the area of the first cylinder, and the same length of stroke, but the cranks are set at right angles, as in ordinary locomotives; consequently, at the moment of the steam being passed into the second cylinder from the first, the piston of the second cylinder is at the commencement of its stroke.

The steam continues expanding in the two cylinders, until the first piston, A, has nearly completed its stroke, when the valve, G, shuts off the communication between the two cylinders, and the valve, D, opens the exhaust port, and communicates with the blast pipe, L, discharging the steam remaining in the cylinder, A, to form the blast in the ordinary manner. The second piston, B, has then arrived nearly at half stroke, and contains nearly one-half of the total quantity of steam originally admitted to the first cylinder; this steam is further expanded to the end of the stroke, and then discharged into the blast pipe, L, by the valve, E, opening the exhaust port.

The return stroke of both pistons is exactly similar to the foregoing, so that about a half cylinder full of high pressure steam (or such other portion as may be desired) is supplied to the first cylinder at each stroke, and between one-half and two-thirds of that steam is discharged at the pressure required to produce the blast, and the remainder of the steam is expanded down in the second cylinder, so as to give out all the available power remaining in it.

For the purpose of enabling the engine to exert an increased power, if required, at the time of starting a train or otherwise, the slide valve, I, is inserted in the centre passage, F, to close the communication between the two cylinders for a short time when required; and the steam from the boiler is then admitted by a pipe and cock into the steam chest of the second cylinder, B, which is then worked independently of the other cylinder, like an ordinary engine.

The comparative quantity of steam or of coke required to perform the same work in the several engines, under the circumstances stated above, is given by calculation as follows:

Continuous expansion engine, . .	100
Ordinary engine, cutting off at $\frac{1}{3}$rd stroke, .	120
" " " $\frac{1}{2}$ stroke, .	154
" " " $\frac{2}{3}$rds stroke, .	185
" " " $\frac{7}{8}$ths stroke, .	220

These figures represent the relative economy in the employment of the steam in the several engines; consequently, the ordinary engine, with the best degree of expansion, or cutting off the steam at one-third the stroke, consumes 20 per cent. more coke than the continuous expansion engine, to do the same work, and from 54 to 85 per cent. more coke with the more usual degrees of expansion; and an engine cutting off the steam at only one-eighth of the stroke from the termination, as many engines were formerly made, would consume 120 per cent. more coke to do the same work.

This plan has been tried upon two locomotives with satisfactory results, and the blast was found to be quite sufficient; but the trial has not been sufficiently complete to afford a definite comparison of consumption.

In the application of the expansion principle to stationary engines, it is requisite to consider the amount of variation in the moving power or laboring force of the engine, and the limits within which it is necessary practically to confine this variation. The accompanying diagrams show the variation in the moving power that takes place between the commencement and the end of the stroke in each of the several engines, all drawn to the same scale and on the same principle, so that the comparison of the diagrams will show the relative effect of the steam in the several engines; the same total power being represented in each case.

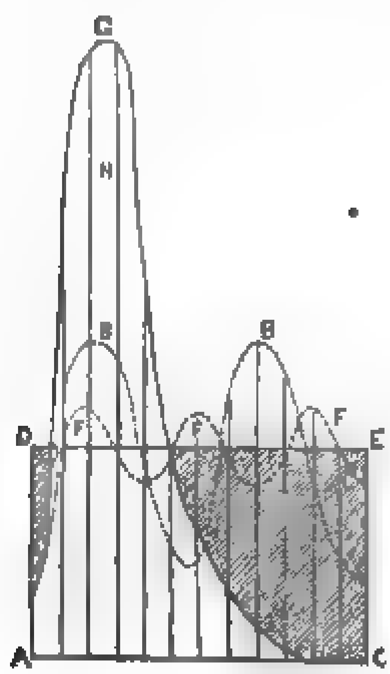


Fig. 3.

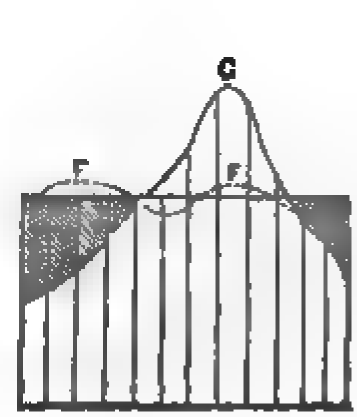


Fig. 4.

Fig. 5.

Fig. 3 shows the variation of power in the Cornish engine, when the steam is expanded down to the limit of useful effect; this is shown by the curved line, A G C. The vertical height of the first division, A D, represents the relative total moving force developed by the engine, in the direction of the revolution of the crank-pin, during the first 15° of revolution from the commencement of the stroke. The heights of the succeeding divisions in fig. 3 represent the corresponding amounts of force developed by the engine during each successive motion of the crank through equal angles of 15° each to the end of the stroke, C, and the half revolution of 180°; the force shown being in all cases the amount that would be produced in the circular direction of the revolution of the crank pin, not in the rectilinear direction of the piston. If the amounts of force in these several divisions were all exactly *equal to one another*, (and the engine, having attained its state of uniform velocity, were employed to overcome a constant resistance to circular motion, such as driving a corn mill or spinning mill, &c.,) then the crank arm would have a perfectly unvarying velocity, and no fly-wheel would be required. And the approach to this constancy of velocity, in any engine applied to overcome resistances to circular motion, will clearly depend on the approach to equality which these amounts of work produced through equal angles make to one another.

The average line, D E, shows this average equal height of all the seve- divisions; consequently the rectangle, A C E D, represents the equiva- it uniform development of power that would produce an unvarying ocity of rotation, and therefore the area of the shaded space, being deficiency in filling up this rectangle of uniform power by the actual rking of the engine, (also equal to the portion H of the curved figure t is above the average line, D E,) will represent the total amount of riation from the average in the moving force of the engine throughout stroke. The area of the shaded portion in this diagram is 43 per cent. the total area, consequently the *total variation* from the average in the ving power of the Cornish engine is 43 *per cent.*, and the *greatest vari- on* at the extreme point G, amounts to 189 *per cent.* of the mean power.

The total variation from the average power,	43 pr. ct.
The extreme variation,	189 "

Fig. 4 shows in a corresponding manner the variation of moving power oughout the stroke in the continuous expansion engine, where the am is cut off at half stroke in the first cylinder, and expanded in the ger cylinder down to the limit of useful effect.

The total variation from the average power is only	13 pr. ct.
The extreme variation,	55 "

nsequently the *total variation* in the moving power in the Cornish en- ie is 3⅓ times as great as that in the continuous expansion engine, and extreme variation is 3½ times as great.

The dotted line, B B, in fig. 3, shows the effect of coupling together o Cornish engines, exactly similar to that shown by the full line in . 3, but of half the total power each.

The total variation from the average power is	20 pr. ct.
The extreme variation	58 "

ie total variation in the moving power being 1½ times as great as in the ntinuous expansion engine, and the extreme variation about equal. This angement would of course be much more expensive than the continu- s expansion engine, as it involves two complete engines.

Fig. 5 shows the variation of moving power in a Woolf's double cylin- r engine, where the pistons work simultaneously in the two cylinders, mmencing each stroke together, and the steam is cut off at half stroke the first cylinder, and afterwards expanded in the larger cylinder down the limit of useful effect, as in the foregoing Cornish engine.

The total variation from the average power is	27 pr. ct.
The extreme variation,	90 "

nsequently the total variation in the moving power is 2 times as great in the continuous expansion engine, and the extreme variation 1⅔ times great.

The dotted line, F F, on fig. 4, shows the effect of coupling together o of the continuous expansion engines at right angles to each other, d the result of this arrangement is a remarkably near approach to per- ct uniformity of moving power.

The total variation from the average power is only	3 pr. ct.
The extreme variation,	8 "

The dotted line, F F, on fig. 3, shows in a similar manner the effect of

coupling together three of the Cornish engines, with cranks at 120° to each other.

The total variation from the average power is	9 pr. ct.
The extreme variation,	22 "

Both being about three times as great as in the continuous expansion engine.

Fig. 5 shows also by the dotted line, FF, the effect of coupling together two of the Woolf's engines at right angles to each other.

The total variation from the average power is	5 pr. ct.
The extreme variation,	13 "

Both being about 1½ times as great as in the continuous expansion engine.

The comparative amount of work performed by the several engines, with the same quantity of steam or of coal in each case, under the circumstances stated above, and taking the pressure of the steam admitted to the first cylinder at 50 lbs. per inch above the atmosphere, is given by calculation as follows:—

Continuous expansion engine, . .	100
Woolf's engine, ...	109
Cornish engine, ...	111

The general result of the above comparisons is, that the *Cornish engine is* 11 *per cent.*, and *Woolf's engine is* 9 *per cent. more economical* in expenditure of fuel than the *continuous expansion engine*, when the expansion of the steam is carried to the *extreme limit* in each case; but that this economy cannot be obtained practically in those two engines, on account of the great irregularity in their moving power, the *average irregularity* being, in the *Cornish engine* 30 *per cent.*, and in *Woolf's engine* 14 *per cent. greater* than in the continuous expansion engine; and the *extreme irregularity* being 134 *and* 35 *per cent.* respectively *greater*.

Consequently, it appears that, although the expansion of the steam cannot be theoretically carried to so great an extent in the continuous expansion engine as in the other engines, yet, from the moving power being so much more uniform throughout the stroke, the expansion can be carried *practically* to a considerably greater extent; and a greater amount of economy may be practically obtained within the same limit of uniformity in the moving power.

Hints on the Principles which should regulate the Forms of Boats and Ships; derived from original Experiments. By Mr. William Bland, *of Sittingbourne, Kent.**

Continued from page 49.

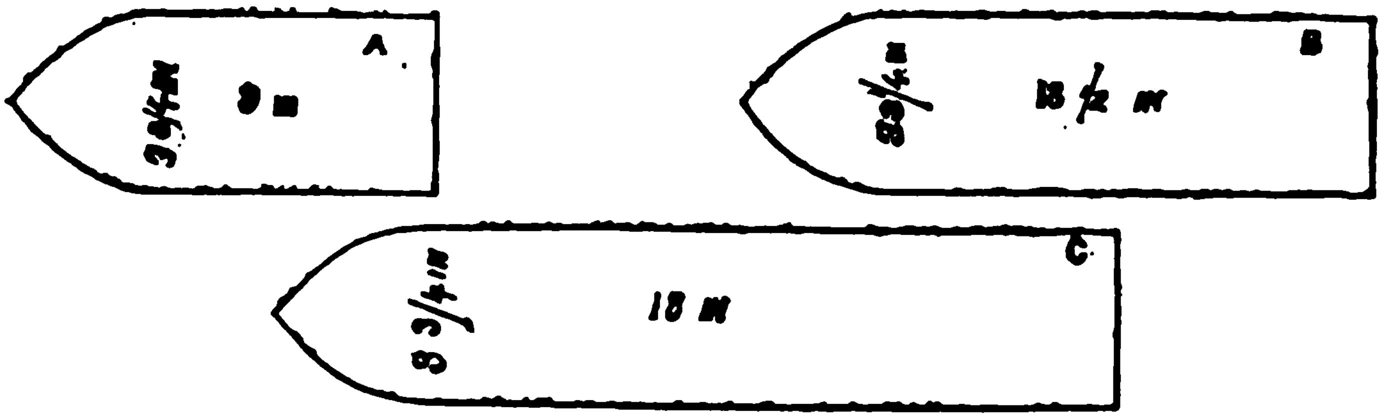
Chapter IX.—Of the Middle Length of a Ship.

The following experiments were undertaken to ascertain the properties of the middle length, or centre body of a ship. Three models having parallel sides, flat bottoms, the same form of bows, and all of the same breadth of beam, namely, 3¼ inches; yet varying in their lengths as fol-

* From the London Architect for September, 1851.

lows, but all of equal weight: length of A, 9 inches; B, 13½ inches; C, 18 inches.

Scale, ⅛th inch to 1 inch. Weight of each 20 oz.

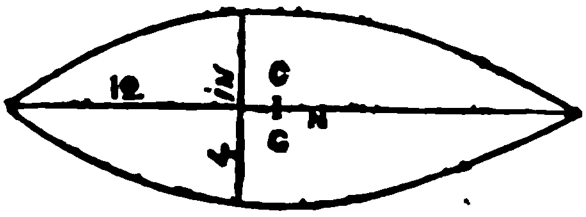


This difference in their respective lengths was made for the purpose of ascertaining the effects of increased length, with regard to speed, and the power of carrying weight.

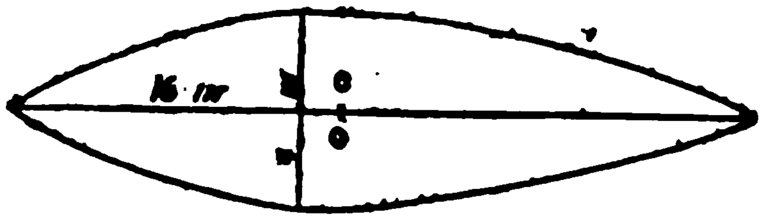
Experiment 37.—The model, A, was tested by the balance rod, with B, and which beat in speed, A, so as to require the weight of 8 oz, to be put into B, to retard its speed to that of A.

Experiment 38.—B, being tested with C, C required the weight of 8 oz. to be put into it, to cause the speed to equal B, being the same difference as in the first experiment; and, therefore, the speed of C will equal the speed of A, and carry at the same time, 16 oz. additional weight.

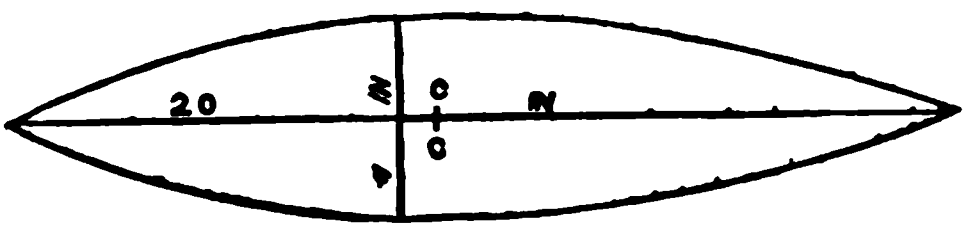
The same law exists in models of a different form, and is instanced in the following experiments. Three models were tested against each other to discover the difference in their speed, having level bottoms, of the same weight and breadth of beam, but varying in their lengths; scale, ⅛-th inch to 1 inch.



No. 1.—Weight, 22½ oz.; thickness, 2 inches.



No. 2.—Weight, 22½ oz.; thickness, 2 inches.



No. 3.—Weight, 22½ oz.; thickness, 2 inches.

Experiment 39.—No. 1 was so far inferior in speed to No. 2, that the extra weight of 12 oz. was put into No. 2 before its speed was retarded to the same rate of speed as No. 1.

Experiment 40.—Now, No. 3 beat in speed, No. 2, as to require 12 oz. to be placed in No. 3, to bring their speed to an equality.

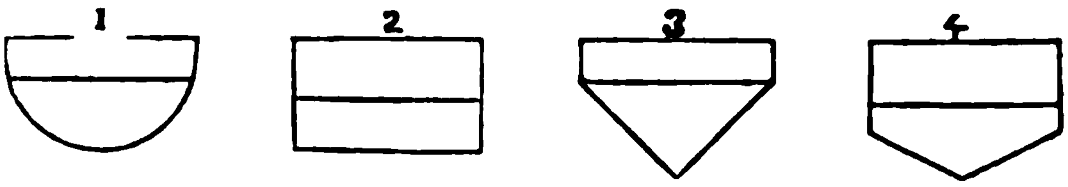
The inference to be drawn from the foregoing experiments is, that additional length *gives increase of speed;* or will carry the weight through

the water with proportional less resistance. The stability, likewise, increases with equal ratio, as given in experiment 7. The cause of this less resistance must arise, in the first instance, from the same dimensions of bows and breadth of beam clearing the way for the increased length of the after part; and, in the second, in consequence of the increased length, which is followed by increased surface bearing; therefore, the whole weight displaces less depth of water—hence arises less resistance when the length alone is concerned. With respect to the increase of the breadth of beam improving speed, the cause proceeds from the curves and the enlarged surface bearing combined; otherwise, the result of the experiments (Nos. 1 and 2, &c.,) would have decided contrary.

Chapter X.—Form of the Midship Section.

This chapter relates to the form of the midship section; its importance as to a ship's speed, and to determine which the experiments, as detailed in the subsequent pages, were resorted to.

Four models, all of the length of 14 inches, and 4 inches wide, having their sides parallel and bottoms level, of equal weight, namely, 30¾ oz., but the midship section of each varying as represented in the diagrams, were tested one with the other; first, to ascertain their speed; next, their stability; third, their lee way; lastly, their burden or floating depth.



Midship Sections; Scale, ⅛-th inch to 1 inch. The dotted line is the float line.

The comparative velocities, as denoted by the balance rod, were as follows:

Experiment 41.—No. 1 beat in speed No. 2 by 2 oz., that extra weight being required in No. 1, to retard its speed till it equalled that of No. 2.

Experiment 42.—The speed of Nos. 2 and 3 proved equal.

Experiment 43.—The speed of No. 4 was the worst of them all, since it required 4 oz. extra weight to be put into No. 1, with which it was tested, before its speed equalled that of No. 4.

The inference to be drawn from the experiments is, that the curve gives greater speed than straight lines with angles. When the bottom of No. 4 had its angles cut off so as to form an ellipse, its speed was in consequence so far improved, that 2 oz. in No. 1 were sufficient; or the velocity of No. 4 became equal to Nos. 2 and 3.

Of the stability and floating depth of the above four models,—

No. 2.	Stability equalled 3½ oz.	Floating depth 1⅛ inch.
No. 4.	Stability equalled 3 oz.	Floating depth 1¼ inch.
No. 1.	Stability equalled 2¼ oz.	Floating depth 1⅜ inch.
No. 3.	Stability equalled 1¾ oz.	Floating depth 2 inches.
No. 4.	Ellipse equalled 3 oz.	Floating depth 1¼ inch.

Here we have No. 2 possessing the greatest stability, and No. 3 the least, both being of the same speed. And again, No. 2 draws but 1 inch of water, whereas, No. 3 draws 2 inches, or double, though of equal weight.

(To be Continued.)

For the Journal of the Franklin Institute.

On the Telegraphic Lines of the World. *By* Dr. L. Turnbull.

Continued from page 45.

United States.

[T]he following is a more correct list of the Telegraph Companies in the [Un]ited States, obtained since the publication of my list in the July num[ber] of this *Journal:*—

[N]ew York and Boston Magnetic Telegraph Company, from N. York [to] Boston, about 250 miles; three wires, one passing through Providence, [Rhode] Island, the other through Springfield, Mass., using the Morse patent.

[M]erchant's Telegraph Company, from New York to Boston, about 250 [mil]es; two wires passing through Providence, using Bain's patent.

[H]ouse's Printing Telegraph, from N. York to Boston, 250 miles; one [wir]e, uses House's patent.

[B]oston and Portland Telegraph Company, from Boston to Portland, [100] miles; one wire, using Morse's patent.

[T]he Merchant's Telegraph Company have one wire from Boston to [Por]tland, 100 miles; Bain's patent.

[M]aine Telegraph Company, from Portland to Calais, Maine, about 350 [mil]es; one wire; Morse's patent.

[S]t. Johns and Halifax line, from Calais to Halifax, about 400 miles; [one] wire; Morse's patent.

[T]here is a line of Bain Telegraph from Boston through N. Hampshire [to B]urlington, Vt., thence to Ogdensburg, New York; about 350 miles; [one] wire.

[N]ew York, Albany, and Buffalo line, from N. York to Buffalo, through [Alb]any and Troy; 513 miles long; three wires, using Morse's patent.

[N]ew York State Telegraph Company, from N. York to Buffalo, via [Alb]any, two wires; 550 miles long, with a branch from Syracuse to Ogdens[bur]gh, via Oswego; about 150 miles; one wire: also a branch from Troy [to S]aratoga, 36 miles; one wire; use Bain's patent. There is also a [Mor]se line from Syracuse to Oswego, about 40 miles.

[H]ouse Telegraph Company, from N. York to Buffalo, via Albany, 550 [mil]es; two wires; use House's patent.

[N]ew York and Erie Telegraph, from New York to Dunkirk, via New[bur]gh, Binghamton, and Ithaca; 440 miles, one wire; Morse's patent.

[N]ew York and Erie Railroad Telegraph, for Railroad use, along the [line] of N. York and Erie Railroad, 460 miles; Morse's patent.

[M]agnetic Telegraph Company, from New York to Washington, via [Phil]adelphia; seven wires, 260 miles; Morse's patent.

[H]ouse Line from New York to Philadelphia, 100 miles, one wire; [Hou]se's patent.

[T]roy and Canada Junction Telegraph Company, from Troy to Montreal, [thro]ugh Burlington, Vt., 260 miles; one wire; Morse's patent.

[E]rie and Michigan Telegraph Company, from Buffalo to Milwaukie, [via] Cleveland, Detroit, and Chicago; one wire all the way; second wire [fo]r *Buffalo to Cleveland;* 800 miles long; Morse's patent.

Cleveland and Cincinnati Telegraph Company, from Cleveland to Cincinnati; 250 miles long; two wires; Morse's patent.

Cincinnati to St. Louis, via Indianapolis, 400 miles long; one wire; Morse's patent.

Cleveland and Pittsburg Telegraph Company, from Cleveland to Pittsburg, 150 miles, one wire; Morse's patent.

Cleveland and Zanesville Line, from Cleveland to Zanesville, 150 miles; one wire; Morse's patent.

Lake Erie Telegraph Company, from Buffalo to Detroit, via Cleveland, 400 miles; one wire; Morse's instrument built under O'Reilly's contract with Morse, with branch from Cleveland to Pittsburg, 150 miles; one wire.

Cincinnati and Sandusky City Line, about 200 miles; one wire; Morse's patent.

Toledo to Terra Haute, via Forte Wayne, about 300 miles; one wire; Morse's patent.

Chicago to Dayton, one wire; Morse's line.

Chicago to St. Louis, via Peoria, about 400 miles; one wire; Morse's patent.

Milwaukie to Greenbay; 200 miles; one wire; Morse's patent.

Milwaukie to Galena, via Madison, about 250 miles; one wire; Morse's patent.

Chicago to Janesville; one wire; Morse's patent.

Buffalo and Canada Junction Telegraph Company, from Buffalo to Lamiston; one wire, connecting with a wire in Canada that runs to Toronto, about 200 miles.

Montreal Telegraph Company, from Toronto to Quebec, via Montreal, 600 miles; one wire; Morse's patent.

Montreal to By Town; one wire; Morse's line.

Having received later information in regard to some of the lines, I would make the following corrections to my article in the July number:

No. 2. "Atlantic and Ohio Telegraph Line" is so referred to as to convey the impression that it ran from Philadelphia to Milwaukie: this is not the case; the line belonging to that company runs from Philadelphia to Pittsburg. The Lake Erie Telegraph Company have a line from Buffalo to Detroit, with a branch from Cleveland to Pittsburg.

No. 4. The New York, Albany, and Buffalo Telegraph, extends from N. York to Buffalo, via Albany and Troy, 513 miles long, having eighteen stations between Buffalo and New York; connecting at Troy with Troy and Canada Junction Telegraph Company; at Syracuse with Syracuse and Oswego Telegraph Company; at Canandaigua with a line from Canandaigua to Jefferson, N. York; at Rochester with a line from Rochester to Dansville, N. York; at Buffalo with Buffalo and Canada Junction Telegraph Company, and with Erie and Michigan Telegraph Company; the latter extending from Buffalo to Milwaukie, via Cleveland, Detroit, and Chicago, 800 miles.

No. 6. There are three companies, if not four, owning the line from Boston to Halifax; from Boston to Portland there are two lines, one using the Morse instrument, and one the Bain instrument; from Portland to Calais,

Maine, one company, using the Morse instrument; from Calais to Halifax, the Morse instrument is used; the line in each province is owned by separate companies, organized under charters from their respective legislatures.

No. 7. The New York and Boston Morse line extends from New York to Boston; to reach Halifax it connects at Boston with lines in No. 6. "Also from N. York via Bridgeport to Birmingham, Connecticut, with eleven stations; there is no such line; there is a branch from New Haven to Waterbury, Conn.; there is no intermediate station.

"In April, 1852, direct communication was had between the N. Orleans Telegraph Office, and the Office of the New Orleans line, in Hanover St., N. York; the whole extent of near 3000 miles of wire having been successfully worked in one circuit."

The entire length of the line from New York to New Orleans, via Charleston, Savannah, and Mobile, is 1966 miles; and this distance was not worked in one circuit, nor can it be with either of the existing systems with the best mode of insulating in use. The instance of direct communication was secured by dividing the line into several circuits, probably five or six, and connecting those circuits through the agency of an instrument termed a connector, the effect of which is to cause one circuit to work the other through the entire series, thus producing a result similar to working through the entire line in one circuit. The connector is an instrument first invented and applied by E. Cornell, Esq., of N. York, on the N. York, Albany, and Buffalo line, at Auburn N. York, to work a branch line from Auburn to Ithaca, for the purpose of taking news reports at Ithaca; at the same time the wire being transmitted from N. York to Buffalo on the main line; this was adopted in the year 1846; it was found to work admirably, and he afterwards modified it so as to make it applicable to working both ways in a main line, or in other words, to make it capable of working a number of series of circuits in a main line; the instrument was adopted for this purpose on the N. York and Erie, and Erie and Michigan lines, in the year 1849, and has been in constant use ever since; by it they having frequently worked direct from N. York to Milwaukie, 1300 miles. The instrument used on the New Orleans line, which was described in my Lectures on the Telegraph, was adopted by Mr. Chas. Bulkley, the then superintendant of the line, who claims it as his invention, made in 1850 or 1851.

The greatest distance that Mr. Cornell has known any lines to work in *one* circuit, was from Boston to Montreal, via N. York, Buffalo and Toronto, a distance of about 1500 miles; this, however, was done when the earth was frozen, and the lines thus insulated by the frost much better than man has yet contrived to insulate them without its aid. There are no lines working succesfully in *one* circuit more than 550 miles; lines may be so insulated as to work in one circuit under states of the atmosphere from 8 to 1000 miles.

"The Atlantic and Pacific range, under the arrangement of Henry O'Reilly, Esq.; using a modification of Bain's Chemical Telegraph and Morse's instrument, from N. York to Washington, and N. York to Boston,

&c., &c." Mr. O'Reilly has nothing to do with either of those lines; he was contractor for building one of them, but has no interest in them, and no control over them. The lines in the west are owned by separate independent companies, over which he has no control. The line from St. Louis to Fort Leavenworth, O'Reilly has nothing to do with; it has been built by other parties in direct opposition to all of O'Reilly's movements.

The Bain Lines in the United States are as follows: "One from New York to Boston, two wires; one from N. York to Buffalo, two wires.

In the list of lines, there are No. 2, from Washington to New York, via Baltimore and Philadelphia, 5 wires, 250 miles each, 1250 miles; at No. 8, Philadelphia to New York, 6 lines, 120 miles each, 720 miles." Those are the same lines each, and they have been duplicated. Including the Bain and House lines, there are only 8 wires between New York and Philadelphia; the 9th one is now being put up by the Magnetic Telegraph Company.

No. 15. Bridgeport and Birmington line has not been in use for two years; is taken down.

No. 22. Troy to Whitehall, via Salem, not been at work for more than a year.

No. 25. Auburn to Elmira, via Ithaca, taken down more than a year ago.

No. 26. Binghamton to Ithaca, via Owego, is a part of the N. York and Erie line mentioned at No. 14, from New York to Fredonia.

No. 31. Cleveland to Pittsburg, via Alton, Illinois; this is an error, as Pittsburg is in Pennsylvania, east of Cleveland, and Alton is in Illinois, west of Cleveland more than 500 miles.

No. 33. *No such line as* from Pittsburg to Columbus, 680 miles; No. 34. No such line as this; there is a line from Columbus, Ohio, to Portsmouth, Ohio, about 100 miles.

No. 37. Columbia to Chilicothe is the same line as referred to above, No. 34.

There is not over 2200 miles of House wire up. "The 6000 miles of O'Reilly lines" are, to a great extent, embraced in the 17,283 Morse lines, and also embraced in the 1092 miles of Bain's line.

There is an "Erie and Allegheny Telegraph Company," having a line from Dunkirk, N. York, via Warren, Pa., thence to New Castle, Pa., and thence to Pittsburg.

Consolidation of Telegraphs.—We learn from the Cincinnati papers, that all the leading Telegraph lines in the West, and South, and Northwest have been united in business interests. The N. Orleans and Ohio line, extending from N. Orleans to Pittsburg; the People's line from N. Orleans to Louisville; the two wires, Louisville, Cincinnati, and Pittsburg line, and the Western line from Wheeling and Pittsburg to Baltimore and Washington city, are all direct parties to the contract—securing these arrangements.

The union brings the Morse and O'Reilly offices in Cincinnati and all other cities on the lines named together. In Cincinnati the Morse lines are removed to the O'Reilly office, which will hereafter be known as the *National Telegraph Office.*

The lines connected directly by this union, connect also indirectly with wires extending over thousands of miles, and embracing within their

ron arms almost every city and large town in the United States. Perlaps there are no lines of equal extent in the world, or working together vith equal harmony, as those radiating from the National Telegraph Ofice in Cincinnati. They are seventeen in number, and embrace in all *en thousand eight hundred and twenty-four miles of wire.*

The following report of the Cincinnati and Louisville Telegraph Combany for 1850 and 1851, exhibits great enterprise, and the value of the elegraph as a mercantile investment in America. It appears that during he preceding year, three dividends of three per cent. each had been paid, ind one quarter's dividend retained for rebuilding the line. The whole um expended for repairs up to June 1851, amounted to $10,405·94. Vith this sum, 83 miles of poles have been reset, 146 miles put in reair, and 156 miles renewed. The receipts during the year 1850, were s follows:

Receipts.		*Expenditures.*	
ouisville, . . .	$22,000·08	Fuel, Gas-Light, Candles, &c.,	$ 642·42
Madison, . .	2,155·99	Rent of Offices, Bridges, &c.,	1,558·70
aurenceburgh, . .	192·60	Stationery of all kinds, . .	1,253·61
Cincinnati, . .	18,470·97	Salaries, ...	18,115·39
Dayton, . . .	2,727·55	Refunded for despatches failing delivery, ...	619·86
Springfield, . .	631·37	Repairs of the Line, .	7,663·30
Columbus . . .	3,403·49	Cost of Batteries, . .	734·25
anesville, . .	1,628·36	Miscellaneous . .	4,425·64
Mt. Washington, . .	72·37	Total, .	35,013·67
Wheeling, . .	2,525·71		
Steubenville, . .	878·08		
Pittsburgh, . .	17,992·17		
Total, .	73,278·72		

Recapitulation.

Total Receipts for 1850, ...		$73,270·72
Paid to connecting lines, . . .	24,788·45	
Expenditures, ...	35,013·57	59,802·90
Total Residue, . . .		13,476·72

Statistics of the year 1850: Number of words transmitted, 3,602,760; number of despatches recorded, 364,559. These are exclusive of free natter, necessarily large at all times. Average hours of labor, fourteen per day. The record of despatches for 1850, on the paper of the registering instrument, covers a length of 1704½ miles: number of hands employed, 58.

The Law of Telegraph in the U. States.—An Act Relating to the Commencement of Actions, &c., Relative to Penalties on Telegraphic Operators, &c.

Sec. 7. That from and after the passage of this act, it shall not be lawful or any person connected with any line of telegraph within this Commonwealth, whether as superintendent, operator, or in any other capacity whatever, to use, or cause to be used, or make known, or cause to be made known, the contents of any despatch of whatsoever nature, which may be sent or received over any line of telegraph in this Commonwealth, without the consent or direction of either the party sending or receiving the same—and all despatches which may be filed at any office in this Commonwealth, for transmission to any point, shall be so trans-

mitted without being made public, or their purport in any manner divulged at any intermediate point, on any pretence whatever, and in all respects the same inviolable secrecy, safe keeping, and conveyance, shall be maintained by the officers and agents employed upon the several telegraph lines of this Commonwealth, in relation to all despatches which may be sent or received, as is now enjoined by the laws of the United States in reference to the ordinary mail service: *Provided*, That nothing in this act contained, shall be so construed, as to prevent the publication at any point of any despatch of a public nature, which may be sent by any person or persons with a view to general publicity.

SEC. 8. That in case any person, superintendent, operator, or who may be in any other capacity connected with any telegraph line in this Commonwealth, shall use, or cause to be used, or make known, or cause to be made known, the contents of any despatch sent from or received at any office in this Commonwealth, or in anywise unlawfully expose another's business or secrets, or in anywise impair the value of any correspondence sent or received, such person being duly convicted thereof, shall, for every such offence, be subject to a fine of not less than one hundred dollars, or imprisonment not exceeding six months, or both, according to the circumstances and aggravation of the offence.

Approved April 14, 1851.

(To be Continued.)

Translated for the Journal of the Franklin Institute.

Note on Galvanic Silvering. By MM. E. THOMAS and V. DELLISSE.

The beautiful investigations of MM. de Ruolz and Elkington, have proved that it is not all the solutions of the salts of silver that give, by the aid of the battery, a constant and adherent layer of metallic silver: that this property is limited to certain special solutions, whose characters appeared to be thus defined:

1st, That the liquid conducts the electricity sufficiently:

2d, That under the influence of the electric current, nothing but silver is deposited.

3d, That the liquid does not attack the metal to be covered.

4th, That the liquid has an alkaline reaction. To these four conditions M. Bouilhet has just added a fifth, which, according to him, is indispensable; that is, that the liquid shall contain a double salt of silver, and a fixed alkali, which in separating, gives rise to the silvering.

There are but two series of solutions which answer these conditions:

1st, The solutions of silver in alkaline cyanides, which are the only ones which heretofore have given results which are constant, and in all respects satisfactory.

2d, The solutions of silver in the alkaline hyposulphite of soda and potassa, which give, indeed, indications of silvering, but shew such variations in the thickness and adhesion of the silver deposited, that notwithstanding their lower price, it has not been possible to substitute these hyposulphites for the alkaline cyanides.

The salts having ammonia for their base, several of which dissolve the oxide of silver easily and in great quantity, are not, according to M.

Elkington, fitted to give solutions capable of silvering. It is, nevertheless, upon this series of compounds that we directed our examinations.

And in the first place, we satisfied ourselves that no salt of ammonia, neutral or alkaline, holding the oxide of silver in solution in water, could deposit metallic silver in a constant and adherent layer; the ammonia coming to the negative pole to destroy the deposit which tends to form there, and attack the metal to be covered.

We had a commencement of success, by employing alcohol as a vehicle, and saturating it with nitrate of ammonia, to make the bath a conductor, then dissolving in it the double nitrate of silver and ammonia, as neutral as possible. But, although this bath gave a thick and adherent silvering, it was subject to too many opposing accidents. The too great alkalinity of the liquid, the lowering of the temperature, the presence of the least trace of chlorides, prevented us from obtaining good results, besides which, the expenditure of electiicity had to be considerable, and the copper to receive the deposit of silver must be first covered with a pellicle of that metal by the operation of whitening.

We were then led to remark that the silvering depended essentially on the reducing property of the bath, and a great number of experiments showed us that although alkalinity was a necessary character in the usual baths, it was an absolute obstacle in the case of the employment of the ammoniacal salts; that far from the acidity of the bath being hurtful, it was indispensable in the same case, provided it was due to an acid greedy of oxygen, and not attacking copper strongly.

We will here remind, that we did not seek to determine the phenomena in silvering by the cyanides, but only the conditions under which it is possible to deposit metallic silver on copper, using solutions of salts of ammonia.

A sealed package deposited by us in the session of the 23d Feb., contains a series of experiments made on this subject, but as we do not yet ask for its opening, because it also contains other researches which we have not yet concluded, we will briefly retrace here our principal experiments:

1st, Whatever may be the solution of silver in a salt of ammonia upon which we operate, it cannot give a constant and adhesive coat of silver unless it contains a free acid, greedy of oxygen, such as the phosphorous, sulphurous, hypophosphorous, and hyposulphurous acids. Thus the neutral or alkaline sulphite of ammonia does not give good silvering; but it gives it immediately when it is made decidedly acid with an acid greedy of oxygen.

2d, All the acids greedy of oxygen do not succeed; this is the case with nitrous acid, probably because it has too much affinity for the metal to be covered.

3d, All the solutions of salts of ammonia capable of dissolving the oxide of silver do not succeed; the solution of silver must, besides, be stable: thus the acid sulphite of ammonia, at first silvers, but soon decomposes rapidly, under the action of the battery, and the silver is almost entirely precipitated from it. But if, to the solution of acid sulphite of ammonia, we add the hyposulphite of ammonia, it becomes capable of furnishing a *more stable bath of silver* and one which gives better results.

4th, The presence of a double salt of ammonia and silver is not sufficient in order that the bath may silver; in fact, the neutral solution of the double nitrate of ammonia and silver does not silver; it gives indications of good silvering, if we saturate it with sulphurous acid. The same is the case with the double sulphite, except the stability of the bath, and *à fortiori*, the same is the case with the double hyposulphite.

5th, The presence of a double salt of silver and any alkali, is not a necessary condition for the silvering by the bath; in fact, the sub-citrate of silver, as M. Regnault showed, prepared by passing hydrogen over the proto-citrate, (precipitated cold, so that no aconitic acid may be found,) gives a solution which silvers well, but which is decomposed during use, which property does not permit it to be employed. The nitrate of silver also gives at first a good silvering, but one upon which the affinity of the nitrous acid for copper, soon exercises an influence.

6th, It appears to us, that in the baths which we have tried, the salt of ammonia has no other utility than to keep the silver in solution, while the property of silvering is entirely due to the presence of a free acid, greedy of oxygen. In fact, this acid acts only by disguising the ammonia without attacking the copper, for if the bath is acidified by sulphuric acid, no silvering is produced. Nevertheless, it may be seen by shaking well cleaned copper turnings with dilute sulphuric acid, that the metal is not sensibly attacked, while the sulphurous acid in the same conditions, attacks it very sensibly.

7th, In the baths which we tried, a platina anode gives better results than one of silver. In fact, the silver anode, either in these baths or in those of cyanide, does not dissolve in proportion to the silver deposited at the kathode; besides, a notable proportion of the silver of the anode is attacked, and precipitated as a sub-salt. Only, in the cyanide baths, it is necessary to employ the soluble anode, to avoid the disengagement of hydrocyanic acid, whilst the disengagement of sulphurous or hyposulphurous acid presents no inconveniences.

8th, To get adherence, the cleaning of the pieces to be silvered must vary according to the reaction of the bath; cleaning by acids gives adherence only in acid baths; it, on the contrary, destroys the adherence in the alkaline baths; this is perhaps caused by the difference of the molecular states of the copper when cleaned by pumice and potassa, or by an acid bath.

In fine, the bath which gave us the best results is a mixture at 8° (Baumé) of bisulphite and acid hyposulphite of ammonia, in which has been dissolved the oxide of silver, or an insoluble salt of that base, such as the chloride for instance.

Several distinguished Savans, MM. Dumas, Payen, Peligot, Edm. Becquerel, have already done us the honor of being present at our experiments, and appeared to admit their reality.

This bath, which appears to obey conditions, altogether different from those which have been heretofore laid down, has, moreover, a decided advantage over the cyanide baths, inasmuch as it is altogether inoffensive to the health of those who are using it, a consideration which perhaps may have some value in the eyes of the Academy. The bath is moreover

ectically economical, for the salts which compose it are of but little lue, and as it conducts electricity very well, it requires much less than alkaline baths.—*Comptes Rendus de l'Academie des Sciences*, (*Paris*,) *th April*, 1852.

Translated for the Journal of the Franklin Institute.

New Arrangement of the Voltaic Couple. Note of M. Fabre de la Grange, *presented by* M. Becquerd.

I have discovered a method of making the current of the voltaic pile, rfectly constant and invariable, even for weeks and months, of whatso- er metals the electrodes may be formed; whether they be put into action separate liquids, as in the combination of Bunsen, or by a single liquid, in the arrangement of Volta.

This continuousness of the electric action is obtained, as is that of the at of a furnace provided below with a grate to let the cinders fall, and ntinually supplied with combustible from above.

The means which I employ is simple, and fulfils all the conditions ich can render it applicable in practice. In place of increasing the pense, it diminishes it.

Let us look first at the arrangement of a single couple with a single uid. Let there be a vessel having a hole pierced in the middle of its ttom; in this vessel, let there be a concentric diaphragm of sail-cloth, ing not so high as the edge of the vessel, and fixed by cement to the tom. Within the diaphragm is a cylinder of very dense gas-coke, rounded by small pieces of the same material, and around the diaphragm ylinder of amalgamated zinc, and acidulated water, which is supplied op by drop from above.

Let us now join the poles by a conducting wire, and let us see what sses in the inside of the apparatus. The acidulated water which con- ues to come drop by drop from above, will pass over the top of the th diaphragm upon the charcoal, which will be thus continually washed the movement of the liquid, without, however, being soaked, so that polarization will be suspended, and the bubbles of hydrogen will engage themselves freely from the interstices of the grains; on the ier hand, the lower layers of acidulated water will, from the effect of pressure which they support, filter slowly through the cloth, which the per and middle layers will not do in any perceptible degree. Now these ver layers are precisely those which contain the sulphate of zinc which to be eliminated. The result is an electric current, which is entirely istant until the zinc has entirely disappeared, and is obtained with- t other care than that of supplying the reservoir.

The following is the method in which I unite a large number of couples: stoneware cups which contain them, being three or four diameters in gth, and consequently resembling tubes, are united and cemented into undle or block easily carried. The upper surface is horizontal, small tters lead the acidulated water to each cup. With this disposition, by cing a second reservoir over the pile, and changing the nature and

height of the diaphragms, it is easy to employ a second liquid, which is dropped directly, and drop by drop on the carbon; as for instance, nitric acid. It is used advantageously very weak, and when it can no longer serve for the Bunsen battery, because it no longer absorbs hydrogen.

The liquids, as they come off from the cups, are collected, and may serve again until they are saturated.

On the Decolorizing Property of Charcoal and several other Bodies. By E. Filhol.*

It is generally stated that charcoal is the only simple body which possesses the property of absorbing coloring matter dissolved in a liquid; it further appears from the investigations of MM. Bussy and Payen, that decoloration by charcoal is a purely physical phenomenon.

Several compound bodies (alumina, sulphate of lead prepared by the moist way, hydrate of lead,) also partake of the property of decolorizing liquids; but it is generally considered by chemists that the action exerted by oxides on coloring matter in the preparation of lakes, is chemical, differing in this respect from that of charcoal; nevertheless, Berzelius was of opinion that the decoloration effected by the oxides and metallic salts resembled that produced by charcoal. My object has been to prove:—

1. That charcoal is not the only simple body possessing the property of decolorizing liquids; sulphur, arsenic, and iron, obtained by the reduction of the hydrated sesquioxide by hydrogen, are all possessed of decolorizing power.

2. That the number of compound bodies having an appreciable decolorizing power, are more numerous than has been thought, and that this power appears to depend much more on the state of division of these bodies than on their chemical properties.

3. That such bodies which easily appropriate one coloring matter may have but little tendency to do so with another; thus phosphate of lime from bones (artificially obtained) scarcely decolorizes the sulphindigotate of soda, whilst it exercises a more energetic influence on tincture of litmus than does animal charcoal.

3. That the decoloration, in the majority of cases, is a purely physical phenomenon; thus the same coloring matter is absorbed by metalloids, metals, acids, bases, salts, and organic substances. It is easy, moreover, by employing suitable solvents, to remove the coloring matter in an unaltered state from the body which had absorbed it.

I do not doubt but that these facts may prove useful in analytical chemistry and in some manufacturing processes.

The following results, which I have extracted from my memoir, will give some idea of the energy with which certain decolorizing matters act

* From the London Chemical Gazette, April, 1852.

y observations were made with one of Collardeau's double lunette lorimeters:—

olorizing Power of different Substances, compared to that of purified Anima. Charcoal, supposed equal to 100.

	Tincture of Litmus.	Sulphindigotate of Soda.
Charcoal, ...	100·00	100·00
Pure hydrate of iron, . .	128·90	1·97
Alumina, ...	116·00	9·91
Phosphate of lime, . . .	109·00	1·97
Iron reduced by hydrogen, .	95·33	100·00
Milk of sulphur, . . .	26·67	0·00
Deutoxide of manganese, (native,)	88·90	13·60
Indigo, ...	80·00	13·50
Oxide of zinc, ...	80·00	6·65
Stannic acid, ...	70·40	0·00
Antimonic acid, ...	[illegible]	1·97
Chromate of lead, . . .	70·40	[illegible]
Litharge, ...	66·66	3·85
Sulphuret of antimony, (native,) .	59·25	0·00
Sulphate of lead, ...	50·00	13·30
Deutoxide of copper, . . .	26·67	0·00
Protochloride of mercury, . .	22·22	0·00
Sulphate of baryta, (artificial,) .	50·00	0·00
Sulphuret of lead, (artificial,) .	130·00	16·67

Comptes Rendus, Feb. 16, 1852.

Ellis' Blooming Rolls.

Mr. Thomas Ellis, of the Tredegar Iron Works, Monmouthshire, is the ventor of a simple modification of the common machine for rolling blooms piles of iron, which possesses some very important advantages over e old arrangement. The system on which it operates is, that the rolls e made to rotate first in one direction and then in the other, so as to roll e pile backwards and forwards in the direction of its length, thus forming both ends of the bloom alike.

Fig. 1.

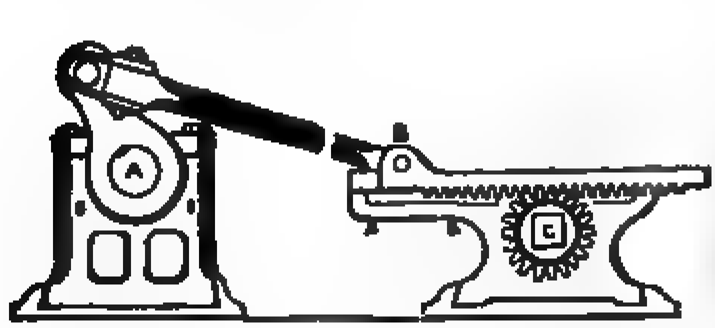


Fig. 2.

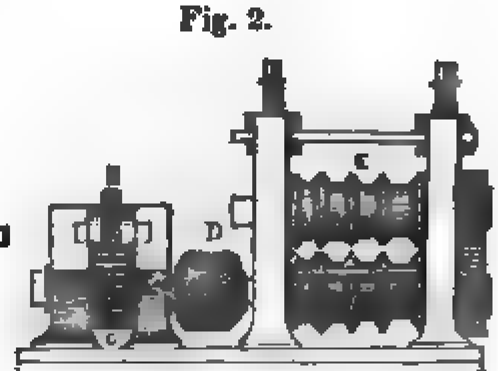


Fig. 1 is an end view of the rolls and actuating crank, the connecting d of which is represented as broken away. Fig. 2 is a view at right gles to fig. 1, showing the rack and pinion apparatus as divested of the iving crank. The power is communicated by the main shaft, A, conmtly revolving, and carrying on its end a powerful crank, to the pin of hich is jointed a connecting rod, passing to an eye, B, on one end of a rizontal toothed rack. This rack slides in guides on the top of a pedes-, forming the bearing of a short shaft, having upon it a toothed pinion, with which the rack gears. This shaft is coupled at D with the lower the pair of rolls, E, so that as the shaft, A, revolves, it gives a continu- s *reciprocatory rotary motion* to the pinion, C, and through it to the rolls.

The result of this sytem of rolling is, that the bar of iron is made of uniform quality throughout its entire length, whilst the bloom does not require to be lifted over the top of the rolls, as is the case at present. Hence arises a considerable saving in time and labor—for two men and two boys are able to roll by it five tons per hour, or sixty tons per day of twelve hours, and blooms of from 10 cwt. to a ton can be managed with comparative ease.

The machine has now been rolling for some time at the Tredegar works, and has passed through it upwards of 13,000 tons without accident.

Remarks.—The old or present system of rolling, by passing the iron between the rollers and then passing it back over them, and again passing it between them, &c., always presenting the same end of the bar first to the rolls, does *not* "make a bar of iron of uniform quality throughout its entire length," as above stated, because the cinder and impurities which are fluid, are driven backward, or towards that end of the bar which comes last through the rolls; consequently, this end always contains more impurities than the one first presented to the rolls.

The plan of rolling described in the foregoing article, would therefore make a bar of iron of "uniform quality," because the cinder would be driven alternately from one end of the bar toward the other, but not driven *out*, as it is in the plan generally adopted.

When it is desired to make a fine quality of iron, we think this plan would not be found to answer satisfactorily, but where a large quantity of ordinary quality is wanted, it would probably do very well. S.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, July 15, 1852.

Owen Evans, Esq., President, *Pro. Tem.*

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations were received from The Royal Astronomical Society, London; Hon. Jos. R. Chandler, M. C.; The Young Men's Mercantile Library Association, Cincinnati, Ohio, and from Messrs. Isaac Lea, Ed. D. Ingraham, R. H. Kern, Dr. L. Turnbull, and George M. Conarroe, Phila.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of May.

The Board of Managers and Standing Committees reported their minutes.

The Committee on Exhibitions reported that they had instructed their chairman to offer premiums for the best designs for a certificate of Third Premium to be awarded at the Exhibitions.

New candidates for membership in the Institute (2) were proposed, and the candidate (1) proposed at the last meeting was duly elected.

Errata.

Page 46, 13th line from bottom, for "that *position* of the former power," read "that *portion* of the former power."

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

SEPTEMBER, 1852.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Remarks on the Rifle. By William N. Jeffers, U. S. N.

The attention of the military and sporting world has been attracted, and its inventive genius stimulated, by the published reports of the extraordinary performances of the needle gun; and Minié rifle. These reports were supposed to be greatly exaggerated; but a repetition of these experiments under other circumstances, has proved that, although the results were not in all respects such as to warrant an abandonment of arms which have passed the ordeal of service, a weapon constructed on this principle is in most respects superior to that which has for so long a period formed the armament of a portion of the troops of all civilized nations. Notwithstanding these disadvantages, there are persons who consider accuracy preferable to simplicity, and who do not doubt that the rifle, in some of its forms, must ultimately supersede the smooth bore, for warlike, as it already has for sporting purposes. But what are the conditions to be fulfilled in making a perfect rifle? This is a problem of difficult solution; perhaps, by collating some experiments which have been made at various times, by order of different governments, we may be more successful in our endeavors to ascertain in what respects these new arms are superior to the old, and be saved the trouble of experimenting ourselves to ascertain results already known.

In firing a musket or other smooth bored arm, there are two causes which affect the ball most injuriously, and cause it to deviate from the line of aim.

The first cause is, that the ball not being either perfectly spherical or perfectly homogeneous, the centre of gravity does not coincide with the centre of figure; consequently the resistance experienced during its flight is not directly opposed to the motion of the centre of gravity.

The second, that the ball generally has a rotary motion on some axis, produced either in the barrel or after it has left it. *In the barrel*, if the impulse of the powder is not in the direction of the centre of gravity of the ball, (an effect similar to that produced by striking a billiard ball out of line,) or by friction against the interior. *Out of the barrel*, because the resistance of the atmosphere is seldom directly opposed to the motion of the centre of gravity. Experiment proves that the rotation always exists; for if a mark is placed on the ball, and that mark placed outward in the barrel, upon firing into a soft substance it will be found that the marked spot occupies every conceivable position in the target.

The existence of an independent and uncertain rotation being proved, it is necessary that this motion should be annulled. This is effected by tracing upon the interior of the barrel spiral grooves, into which the ball is forced by ramming, or otherwise; the ball, upon the charge being fired, follows the direction of the grooves and issues from the barrel in the manner of a short screw of several threads from an elongated nut, the axis of the ball coincident with that of the barrel; this causes a rotation which preserves the axis constantly parallel to its initial direction during the time of flight, presents any inequalities of weight or of figure alternately to the right and the left, above and below the line of flight, thus equalizing the causes of deviation. This last, however, is not strictly true; for the causes of deviation are more energetic nearer the muzzle, consequently, if the progressive velocity is very great, while that of rotation is but feeble, the resistances are not equal at the points where the inequalities are on opposite sides of the axis, and a deviation will occur. Rifling the bore, therefore, diminishes, but does not entirely overcome, the deviating forces; in fact, it introduces certain deviations, small in amount, but peculiar to itself, which will be hereafter noticed.

It is a known and generally admitted fact, that by diminishing the windage of the musket, (*windage* is the difference between the diameters of the barrel and the ball,) we increase the accuracy; taking into consideration the preceding facts, some persons have expressed doubts as to the necessity of rifling the bore, and have asserted that by causing the windage to entirely disappear, that is, *forcing* the ball, as great a degree of accuracy can be attained as with the rifle; experiments made with smooth bores, and the same barrels afterwards rifled, proved conclusively that the rifle is greatly superior in accuracy.

The theory of the effect of rifling would also appear to render unnecessary any experiments upon straight grooves, since they cannot cause the ball to rotate; nevertheless, comparisons were made, and the results found to differ but little from those obtained with the smooth bore, and of course greatly inferior to the rifle.

Having thus determined that for accuracy at considerable distances, it

was necessary to adopt the principle of the rifle, a series of experiments was made to determine—

The Mode of Loading.—Loading at the breech. This mode is the oldest known, and has several advantages; the principal are, an increased range and accuracy, and less recoil on account of the reduction of the charge; to these advantages we may add, when the mechanism for closing the breech is well arranged, facility and rapidity of firing, the importance of which is greatly exaggerated by inventors, but which is not without real value, are greatly increased. Unfortunately, it appears difficult to combine all these advantages with strength and simplicity, and above all, capability of furnishing prolonged service under the ordinary circumstances of a war.

The Prussian needle gun is one of the latest arrangements for loading at the breech; (a complete description of this gun is to be found in *Appleton's Mechanics' Magazine* for March); it has sustained the effect of protracted firing without injury; the arrangement is objectionable in several respects, but a fatal one is, that if the needle fails to ignite the priming, the cartridge must be withdrawn. Jennings' repeating rifle also loads at the breech, and is probably one of the best of this order of rifles.

The cartridges of these two rifles are arranged upon precisely opposite principles. In the needle gun, the powder adjacent to the ball is first ignited; consequently, the ball when once in motion, is driven forward by a force less than that due to the greatest tension of the gas; for this force is evidently greater at the breech, where the combustion of the grains and evolution of gas is still going on, than at the place of the ball some distance off. In the Jennings rifle, the charge is ignited at the bottom; the loaded hollow ball carries the powder within it, and as the grains are successively consumed, the greatest tension and elastic force is exerted upon the ball at the instant and at the point where the last grain is consumed; a very small charge, therefore, produces a maximum effect.

Loading at the muzzle. This method takes more time than the preceding, fatigues the loader more, and increases the wear of the barrel to such an extent, particularly near the muzzle, that it is doubtful whether the greater simplicity of construction compensates for its inferior rapidity and difficulty of manipulation, and after some service, its diminished accuracy. Numerous methods of loading have been proposed to diminish these disadvantages.

1st, Loading with the aid of the mallet. This method is very objectionable, except for short distances as in pistol galleries, where this mode is usually adopted; any mode of forcing the ball which deforms it, as hard ramming or driving with the mallet, is injurious to the range, but favorable to accuracy, as it is susceptible of demonstration that the shortest axis is the axis of the greatest moment of inertia around which the motion of rotation is the most stable.

2d, With a greased patch. This method has almost entirely superseded all others; at the same time that the patch destroys the windage, it cleans the barrel for the next round. It is not, however, without serious objections; if the ball fits tightly, it is difficult to enter and force home with the ramrod; if the ball enters easily, it must be forcibly rammed, when home, to spread it into the grooves; an operation at once fatiguing to the loader,

and injurious to the shape of the ball. To assist in loading, there is furnished with the best American target rifles a *straight starter*, and a false or loading muzzle, which enters the conical ball fairly.

3d, The belted ball. The English military rifle has but two grooves; the ball, cast with a belt upon it, is enveloped in a greased patch, and the loading is performed with but little greater difficulty than with the musket; this is a very rude weapon, and except at very short ranges, has little accuracy or force; it is not astonishing that a people using a weapon which, compared with a Wesson's American rifle, stands in about the same relation to it that the bow and arrows do to a musket, should consider the authenticated performances of the latter as fabulous.

4th, The elliptical ball fired from a helical elliptically bored barrel. This idea, which has lately been reproduced in England under the name of Lancaster's elliptical *rifle*, dates from 1795; the practice with, has demonstrated that it is, independent of the difficulty of construction, inferior to all the modern rifles.

5th, The *carabine à tige*, or French pillar breeched rifle. This has also been imitated in Lancaster's pillar breeched rifle, and Wilkinson's stadia rifle. In this rifle, a steel pin, or pillar, about half the diameter of the bore, and three inches in length, is screwed into the centre of the breech pin; the powder fills the space around this pillar, and the ball is arrested by the end which is a plane; moderate ramming with the rod, spreads the ball into the grooves without crushing the grains of powder, or seriously deforming the ball; it was for this rifle that the grooved cylindro-conoidal ball was invented, which has reached a range and degree of accuracy hitherto unequalled.

6th, The Minié mode of loading. The accumulated dirt in long continued firing, and the difficulty of cleaning the breech, caused serious objections to be raised to the preceding mode of loading. Mr. Minié, therefore, proposed to hollow the base of the conical ball, and enter in it the point of a conical iron cup, or plug, which should be driven into the cavity by the force of the charge, expand the ball into the grooves, and thus force the ball without effort on the part of the loader. The loading is as rapid and simple as with the musket, and no alteration is required in the rifle; the ball alone is of different construction. The numerous and severe tests to which it has been submitted in Europe, would appear to be perfectly satisfactory, and it has been adopted by several nations. Still, it is open to objection; one of which is, that if the cartridge is damaged by exposure, the expansion may be either irregular or inefficient, and all accuracy lost. A small quantity of fulminating powder inserted in the cavity, would also produce the required effect, but the union of fulminating powder with the cartridge is highly objectionable, either in magazines, or during transportation from place to place. The great advantages of this discovery may lead to the adoption of the rifle as the sole weapon of the infantry soldier.

The Charge of Powder.—The charge of powder is only to be obtained by experiment; it should be sufficient, but not excessive. We must, therefore, consider, 1st, the quantity of powder which can be burnt while the ball is passing along the barrel: 2d, the required range, force, and accuracy: 3d, the recoil. Experiment proves that heavy charges pro-

duce great irregularities, and that the accuracy increases with the diminution of the charges; hence, the smallest charge capable of producing the required effect, is to be preferred. The recoil being directly proportional to the charge, it is evidently favorable to accuracy to employ small charges, by which we also diminish the inconveniences of fouling.

The Diameter and Shape of the Ball.—When the rifle loads at the breech, the ball should be of slightly greater diameter than the barrel, that the ball may be *forced* (caused to fill the grooves) by the action of the charge; if loaded at the muzzle, the ball must be somewhat smaller, or it will be deformed by the blow of the mallet, or other means adopted to enter it; it must also be of such diameter that the fouling of the bore will not prevent it from being rammed home; at the same time the windage must be sufficiently small to permit the spreading of the ball to fill the grooves without excessive ramming, which fatigues the loader and deforms the ball.

Hitherto, the spherical ball has generally been used, but it has been proposed to substitute a conical, cylindro-conical, or cylindro-conoidal ball; the first attempts were not successful; the ball was found to be deficient in stability, and abandoned.

When a spherical ball is fired with great velocity, the air in front is partly displaced, partly condensed, and driven before it, the particles forming a sort of conoid, having a base equal to the diameter of the ball, and a height dependent upon the velocity. If, then, the anterior surface of the ball is made the shape of this conoid, the escape of the condensed air will be facilitated, and the resistance due to its elasticity reduced to a simple friction. But since the axis of the conoid passing through its apex is that of the least moment of inertia, the conoidal ball is more affected by causes of deviation than the spherical ball; to overcome these defects, it becomes necessary to increase the rapidity of rotation; and since the elongated ball offers a great surface to the action of the grooves, there is no difficulty in combining a rapid rotation with considerable velocity. This developed a new deviation peculiar to the rifle, due to the parallelism of the axis of rotation. This deviation, which was named by the discoverer *derivation*, was observed to be always to the right or the left of the object, according as the turns of the spiral were from left to right, or right to left; and, increasing with the rapidity of rotation and the distance, can only be due to the rotation itself.

If we fire an elongated ball at a distant object, the axis of the rifle must be aimed sufficiently above it to compensate for the effect of gravity; the axis of the ball on issuing from the muzzle, takes the direction of the line of flight, the resistance of the air is concentrated upon the apex, consequently, the friction caused by the rotation is distributed equally around the ball, and there will be no deviation; but as the ball approaches the target, the axis, preserving its parallelism, makes an angle with the path of the ball, the anterior surface experiences greater pressure from the condensed air in front, while the posterior surface is in a vacuum, and there will be an unequal friction, which will impel the ball towards the right or left, depending on the direction of rotation. At 900 yards, with a cylindro-conoidal ball, the derivation amounted to four yards.

A careful study of these effects led to a discovery of the causes pro-

ducing and the means of correcting them, and subsequent experiment arranged the details of the *grooved* cylindro-conoidal ball, which in the *carabine à tige* and Minié rifle, has proved so efficacious.

The theory of this ball is easily explained. The centre of gravity of the ball being in the line of flight, and the axis making an angle with that line, any resistances in the rear of the centre of gravity must have a tendency to cause the ball to turn on that point, and make the axis of the ball coincide with the line of flight. This resistance was produced in the model ball by forming on the cylindrical part several circular grooves of a triangular section, the rear face perpendicular to the axis of the ball. Experiment fully confirms what theory designated as the remedy. The axis of the ball is constantly directed in the line of flight, the *derivation* disappears, the ball experiences the least possible resistance, and retains an almost incredible degree of force and accuracy at distances beyond the limits of distinct vision.

The Length of Barrel.—The charge should be such that its inflammation may be completed before the ball has left the gun; but as the charge is fixed in advance at the least quantity to produce the required effect, it follows that the barrel should be shortened to that point. An excessive length can but increase the friction and diminish the range, while experiment shows that it injuriously affects the accuracy.

The Inclination or Twist of the Grooves.—To determine this, we must examine the relations existing between the charge of powder and the inclination. It is evident that with equal charges, the rapidity of rotation increases with the inclination; it would therefore appear to follow that the accuracy should correspondingly increase; but as the rotation is produced by the friction of the ball in the grooves, if the charge is great and the twist quick, the small portions of lead entering these grooves are not capable of offering sufficient resistance to rupture, the ball will not follow the direction of the grooves, it must be cut or stript, and issue from the barrel greatly deformed, and totally devoid of accuracy. On the other hand, if the inclination is too small, the rotation will not be sufficiently rapid to overcome the several causes of deviation; it follows that we must increase the length of the spiral as we increase the charge.

The experiments to determine this point were made upon two natures of twist; the uniform, and the parabolic or increasing twist. In conformity with the laws of the motion of bodies, we should progressively increase the inclination of the grooves to the axis; for the ball being subjected at the same time to two motions, necessarily has a tendency to escape from the grooves; and the greater the inclination, the more difficult it will be to overcome this tendency; therefore, there should be some ratio established between the velocities of the motions of rotation and of progression. The experiments proved that for a quick twist of a turn in three to six feet, the increasing twist was preferable; but that for a spherical ball of musket calibre, a twist of about one-seventh, or a turn in twenty feet, was sufficient, and that for this length of twist the increasing twist had no advantages. The conical ball rotating on the axis of the least moment of inertia, requires a more rapid rotation to insure the stability of this axis; furthermore, the effect of the deviating force increasing with the diminution of the bore, it follows that the smaller the diameter of the ball, and the

greater its length in proportion to its diameter, the more rapid should be the twist. Rifles have been made in this country with a twist ending with a turn in eighteen inches; if this excessive twist was necessary to insure the stability of the ball, there were defects in the rifle, and the shape of the ball, which should have been remedied. Experiment shows, that with the same charge and more than a necessary degree of twist, there is a loss of range, accuracy, and killing force, at long distances; this is conformable to theory, for the friction and loss of force evidently increases with the twist.

Experiments were also made upon the *decreasing twist.* This idea has lately been reproduced and advocated by Greener in his treatise on the gun; these experiments proved that this was decidedly the least advantageous of all the methods proposed. The projectors of this arrangement argued, with some plausibility, that the velocity of rotation, (that is, the number of turns in a second of time,) was not due to the inclination of the grooves alone, but also to the velocity of the ball; and as this velocity was constantly increasing until the ball reached the muzzle, the inclination should decrease, that the ratio of the velocities should remain constant.

The Number of Grooves.—It has been shown, that diminishing the twist, to a certain limit, was attended with increased range and accuracy. Similar results attended a reduction of the number of grooves. At least two grooves are necessary; a single one would cause deviations from the instant the ball left the barrel. The number should be such that but moderate ramming is required to spread the ball into the grooves; for if the number is small, the depth must be correspondingly increased, to give sufficient hold to prevent the ball from stripping. If the number of grooves is an even number, the ball must be enlarged by ramming in the direction of a diameter by twice the depth of the groove; if the number is odd, the solid opposed to the crease assists in spreading the ball into the grooves. For these reasons an odd number is to be preferred; from five to seven is the preferable number. The *carabine à tige* has four, the Minié rifle five; some rifles have upwards of a hundred.

Depth of the Grooves.—The depth should be such that a moderate force will cause the lead to entirely fill the groove; otherwise a portion of the inflamed powder will escape through the grooves, injuriously affect the range and accuracy, and injure the barrel. If the grooves are very deep, the projections raised upon the ball will diminish its velocity and accuracy; consequently, too great a depth cannot be otherwise than injurious. Experiment must determine for the particular calibre and charge the least depth necessary; arms loading at the breech require a greater depth than those loading at the muzzle. The grooves should be of equal depth, *at the same distance* from the muzzle, or the unequal projections raised on the surface of the ball may cause great irregularities. Recent experiments have, however, shewn that it is highly advantageous to diminish the depth of the grooves *as they approach* the muzzle, and even that no injury is produced if a few inches near the muzzle are left smooth; this arrangement keeps the ball constantly fixed solidly in the groove, while the friction against the *lands* (or solids between the grooves) is scarcely sensible; the ridges raised on the ball by ramming almost entirely

disappear. In the American target rifle, particularly those of Wesson's make, the same object is sought to be attained (the solidity of the ball) by freeing the bore from the muzzle towards the breech; this method is attended with increased friction, on account of the greater surface of lands than of grooves, and has also the disadvantage of increasing the ridges raised by ramming.

The Shape of the Grooves.—A great many trials were made of grooves of different cross section. Of all the forms tried, the rectangular, with the interior angles rounded off, proved superior; for since neither the lead nor the patch can be forced into the angles of other grooves, they permit an escape of gas injurious to range and accuracy. It was also found preferable to have greater width of lands than of grooves; and that for the number adopted, three-eighths of the total circumference was sufficient.

The Thickness of the Barrel, and Material of which it is composed.—It is a firmly rooted popular opinion, that the barrels of rifles must be very thick, and the weapon heavy and unwieldy, to fire with accuracy; but repeated experiments have proved that a diminution of thickness and of weight had no injurious effect upon the accuracy, except so far as it increased the recoil, with charges much greater than any proposed for service. The musket barrel rifled gave results equal to the rifle of equal diameter of ball, weighing two pounds heavier. The homogeneity of the material composing the barrel is of much greater importance; a want of this quality causes an irregular vibration and a curvature of the barrel from unequal expansion. To insure a greater degree of it, the barrels of rifles, formerly made of iron, are now universally manufactured from cast steel. In addition to greater strength and homogeneousness, its hardness preserves the muzzle from wear, a matter of very great importance; for any aperture which may permit the gas to escape before the ball leaves the muzzle, must cause an initial deviation variable in amount, therefore not to be counteracted. For this reason, the best American target rifles are furnished with a false or loading muzzle, and the conical ball is entered with a straight starter, which preserves its axis perpendicular to the plane of the muzzle.

Vibration of the Barrel.—It is generally supposed, that by firing several successive shots from a rifle always charged and pointed alike, at a target placed at a short distance, the balls could not deviate in any direction, and therefore should pass through the same hole; but this is not the case. Upon firing several shots, from different barrels, through a piece of pasteboard placed six feet from the muzzle, it was observed that after a certain number of rounds, a circular opening was formed nearly double the diameter of the ball, the centre of which coincided with the axis of the bore. It was also proved that like results followed the use of the rifle and the musket, and that the deviations were in all directions. These results can only be attributed to the vibrations of the barrel.

These vibrations are of two sorts; the one perpendicular to the axis occasions a momentary swelling; the other, longitudinal, displaces the axis itself by an oscillatory movement; this longitudinal vibration, which is the most important, increases with the charge and the checks to a free recoil; the barrel recoiling freely, the vibration is scarcely sensible. It is also proved that recoil commences before the ball leaves the barrel.

The deviations being similar near the muzzle for all the barrels, rifled or smooth bore, good or bad, it is evident that the deviations at great distances can only be attributed to the resistance of the air; another proof that the principle of the rifle is necessary to diminish the effect of this resistance, but cannot cause the deviations to entirely disappear; also, that the figure and weight of the ball are of much greater consequence than is generally supposed.

A careful study of the facts brought together in the preceding pages, has led the writer to the following conclusions:

That the American rifle made by the best makers is a nearly perfect weapon, principally faulty in the smallness of the bore and too great length and weight of the barrel. But while the weapon itself so nearly fulfils the theoretical and mechanical conditions necessary for a successful practice, the manipulation and accessaries are decidedly faulty. The loading is difficult, tedious, and requires much practice and expertness; the balls are generally very acute conoids, with plane or hemispherical bases, the most susceptible of all forms to deviations; the rifle is in practice greatly overcharged, endeavoring to obtain by great velocity of ball a force and accuracy better obtained with a better form and greater weight. The heavy charge requires great strength of barrel, and consequently thickness and weight, to withstand its force, gives considerable recoil, and makes it necessary to clean the gun after a few rounds.

Practice with a rifle in the possession of the writer, made by Wesson, (admitted to be the best of makers,) of a calibre of forty-five spherical balls to the pound, proves these conclusions to be correct. The barrel, freed from near the muzzle towards the breech, was thirty-four inches long, rifled with an increasing twist, ending with a turn in six feet. The ball is purely conoidal; consequently, unless it is entered with the utmost nicety, the axis does not coincide with the axis of the bore; the charge was so great, that unless the ball was hardened with tin, it was frequently upset by the force of explosion.

The charge was subsequently reduced one-half; the ball increased in length to two diameters, three-eighths cylindrical, the other portion conoidal, the tangents to the curve at the apex forming an angle of about 70°; three grooves were formed upon the cylindrical part of the ball; the barrel was shortened to thirty inches. These alterations have been attended with the expected success. At the distance of forty to sixty rods, there is no perceptible advantage; but on increasing the distance, the superiority becomes more marked, till at 150 rods the accuracy is nearly doubled.

To obtain satisfactory results, so many precautions are necessary, so much practice required, and so long a time required to load the rifle, that it is not probable that such a weapon will ever be used for any other purpose than target practice, and some more convenient weapon must come into use.

The principle of loading at the breech, although liable to objections, must be admitted to be very advantageous, and can scarcely fail to be adopted for sporting purposes, arming of volunteer troops, and even a portion of the regular forces. Although the rifle so constructed is some-

what more difficult to manufacture, it is, by dispensing with the ramrod, more conveniently handled: if the mode of closing the breech is well arranged, the duration of the arm is at least equal to that of a rifle loading at the muzzle. The manual is more simple, easily learned, and the rifle may be loaded with facility even when lying down; the charge being small, the injuries due to its corrosive action are sensibly diminished: the recoil is scarcely perceptible, and the gun may be loaded an unlimited number of times without cleaning: for the same weight of gun, the bore may be larger, which has been shown to be advantageous.

A rifle on this principle, of a half inch bore, (32 to the pound,) properly constructed, firing a conoidal ball, with a charge of thirty grains of rifle powder, will be effective at half a mile, a distance beyond the limits of distinct vision, or our means of estimating distances with precision.

For the Journal of the Franklin Institute.

Railways and other Roads. By J. H. Fisher, Esq.

I propose to examine the question, whether the railway is the form of road which, so far as we now can see and judge, is the most economical and agreeable for populous districts.

Inventions are often the offspring of accidents, and always more or less modified by accidents. Roads, more than other inventions, have been subject to such modification, and turned from their normal growth by it; and until freed from it, they cannot attain to a condition that will satisfy the requirements of the various kinds of travel that must pass over them.

The motive power is the first accident that has modified roads. Without going back to semi-barbarous ages, in which none but rude vehicles existed, and roads were pathways of common earth, I will notice the modifications now adopted to accommodate them to animal power. Stone pavements are grooved, sometimes roughened over their entire surface, to give a firm foothold to horses; they are made of stones so small that they will form an uneven surface. All this roughness and unevenness of surface is injurious to the road as a street track, but necessary to enable the animals to obtain such a foothold as will resist the tendency to slip.

Railways, from their beginning until locomotives were introduced, were made for burdens so heavy that the common roads of the time could not bear them; and in order to draw such loads, it was necessary that the horse track should afford a secure foothold. The earliest were mere timber tracks for the wheels, with the common earth, or at best a gravel track, between them. As it was found that the timber would not without injury bear the pressure of the wheels, strips of iron were put upon them; and finally, iron rails upon cross sleepers of timber came into use, as the locomotive gradually developed itself.

It appears to me that the narrow wheel track, which could not have been kept except by slow moving vehicles, and the flanch rail or tram, were too obviously inconvenient to have been adopted, were it not for the necessity of a surface into which the horse could indent his toes, and

a firm hold; and thus far at least the railroad seems to have derived n from accident.

us now consider what might have been the form of the early col- oads, had timber been cheap enough to make the whole surface of l had there been a varied and abundant traffic, requiring different of speed, turn-outs, stoppages, and all the impediments of roads in ous districts, and had the locomotive attained to the efficiency and ness of structure that characterize the light locomotives of the pre- ay. The service required was to draw heavy loads at a rate so slow very simple steering apparatus would have sufficed. It was neces- or at least desirable, that the colliery vehicles should pass each and other vehicles could not use the road unless allowed to pass by the burden vehicles. There can hardly be a doubt that the surface would have been timber; and a plank road, of the thick- nd strength required for the service, would have been the result. if the locomotive had attained to this condition at the time when ngthwise timber track was guarded from the crushing weight by a of iron, the question of a fulcrum for the motive power would have been settled, and an iron surface would have been adopted, unless rse traffic were of such amount as to require a less slippery surface. e case actually stood, there was an accident, which would have less influential in the case we have supposed, but which had much with preserving the railway form. I allude to the strange notion he adhesion of the wheels was insufficient to enable the locomotive w a load, or work upon a smooth surface more advantageously than s could work. To overcome this imaginary difficulty, the toothed Blenkinsop, and various imitations of horses' legs, were devised; them requiring that the rail should be preserved. This delusion have been dispelled sooner, had the grades not been so steep that ng would in some cases unavoidably occur if the loads drawn after comotive were of the usual weight that it could draw upon the lesser es.

ese accidents, concurring perhaps with others, seem to have given a system that could not have grown to its present magnitude had e minds of the engineers, or mere workmen, been incapable of tho- ly investigating the subject before them. Step by step, the rail n advanced, from the timber track to the tram, from the tram to the r the flanch wheel, from the light and flimsy rail to the heavy and ail now in use. In the mean time the traffic increased, and demand- ompt and unremitting action, rather than deliberation. Inventors required to determine how to time the trains, and avoid collisions elays. This they accomplished by diminishing their number, and sing to an enormous weight and size the cars and engines, so that d of the three or four tons which a convenient passenger vehicle have weighed, the passenger train now weighs a hundred tons or

hile railways have been growing in this way, some efforts have been to improve common roads; but they have been hindered, and until n a few years defeated, by the difficulties which lie in the way of grading, and by the requirement of a surface upon which horses

can draw heavy loads without stopping. Cast iron pavements were tried in London twenty years ago, and abandoned because they were slippery. Stone tracks, composed of long dressed stones, with rough horse tracks between them, have been used where there is but moderate traffic. But in the main thoroughfares the improved wheel surface has been deemed an insufficient compensation for the danger of injuring horses, and stopping crowds of vehicles by their fall. A new trial of iron paving is now being made in Glasgow, thus far with such satisfactory results as make it probable that it will be generally adopted. The grooving is improved, so that the old difficulty of slipping is avoided; and the structure is cheaper, and promises to be more durable, than stone pavement. The cost is within two dollars per square yard; and if allowance be made for the exemption from the necessity of such repairs as are required by the wooden portion of railways, it appears that an iron pavement of sufficient width for turning out will not cost more than a double railway.

If we now suppose that horses are on the whole as expensive as steam power, in the present state of invention and workmanship, we may fairly assume that a road can be made of iron, with a surface and grade equal to the railway, which will accommodate every variety of traffic, and admit the use of vehicles that can diverge from it to reach the places where their burdens are to be set down and taken up. It is a fact well established, that no kind of road in ordinary condition is absolutely *impracticable* to steam carriages, however *unprofitable* it might be to run them upon bad roads alone.

Upon such a road there would be no necessity for mammoth trains, starting at long intervals, and stopping only at distant stations, requiring passengers to pay two coach fares in addition to the railway fare, in order to complete their journey. The loads would be light, and go without change of vehicle from their departure to their destination; passenger vehicles that must move rapidly, would be light, so that if they should run off the road, no damage could occur; and accommodation stages and private carriages could again come into use, and move as rapidly as the locomotive; and as they would avoid the delay of transhipment, they would perform their service with more despatch than the railway, at least upon short lines of travel.

Such a road could be sodded to the edge, and perfectly free from dust; and as it would be supported at all points upon a bed of concrete, and free from roughness, the wheels would run over it with very little noise or jolting. A smooth and quiet motion, with the privacy of one's own vehicle, and the comfort of having it well ventilated by the blowing-fan, and warmed by the waste steam, would render travel a luxury to be enjoyed, rather than a necessity to be endured, as it often is under the present system, especially in dry and dirty weather. And were street pavements made of iron, and horses not used, they would be free from dust and mud; and the expense of cleaning would be slight—the rain alone would keep them always cleaner than stone pavements can be kept by the usual process.

The expense of such a system should be estimated by a fair comparison of its utility with its cost to *all* who aid in paying for it. The cost of paving, street cleaning, road making, and much of the cost of clothing,

are fairly chargeable under the general head of cost of transit; but it has been too much the custom to look solely to the total expense of maintaining horses and their vehicles, and comparing it with the cost of other motive power, without reference to the comparative wear of the public roads, to the damage to private property and comfort by dust and mud, to the time lost in traveling, and to the wear of vehicles, and other expenses incidental to the form of road which we have assumed as the temporary and imperfect form. If the damage to clothing, comfort, and health, were much less, there would be a gain; not, however, to the coach proprietor, and he would not pay for it; if the time of travel were less, there would be a gain, but not to the public carrier; if street cleaning were lessened, there would be a gain, for which the coach proprietor might be willing to pay a part. But all these interests, and many others, will remain without the union that would produce reform, until the public constructs the roads, and distributes the taxes according to the benefits. If a road be made agreeable to the fastidious tastes of the wealthy, always perfectly clean, free from uncouth sights, and its sides beautifully ornamented with trees and shrubbery, it would be just that the pleasure carriages of that class should pay a tax somewhat proportioned to their value, and that the plain vehicle of the man in moderate circumstances should pay less. Part of the tax would be for embellishment—that part should be assessed chiefly upon those who would not willingly dispense with it; another part would be for wear of road, and that part should be assessed as a mileage tax, or, what might amount nearly to the same thing, each keeper of a carriage should pay a certain amount upon the renewal or repairs of his wheels.

But during the transition state, while horse power and elementary power are struggling for ascendency, roads will be of a mixed character. The general form of the train or track road will be more or less adopted. If iron be the material, the horse tracks will be grooved, and the wheel tracks smooth. But it will be found that habit and training will accustom horses to the smooth surface, so that, with light loads, they will not slip. The grooving will soon be dispensed with upon the level portions. In the mean time, every year will cheapen and improve machinery, until it will be no longer expedient to provide for the use of horses; and the roads will then be made of their normal form.

The present cost of steam power is a question of interest, which is more or less discussed, in England and this country. A select committee of the House of Commons, in 1831, after hearing the evidence of the proprietors of steam carriages, and numerous men of science, reported that steam carriages would become "a speedier and cheaper mode of conveyance than carriages drawn by horses." This prediction is by some thought to have failed; but what is the locomotive? it is a steam carriage, of huge size and proportion, running upon narrow tracks. This steam carriage has reduced the cost of traveling to a third, and increased the speed eightfold. Lighten it, give it a steering apparatus, run it upon a broad, flat surface, with railway grades, and you will not have impaired its efficacy; it is even now maintained in England, that two light locomotives to a train, are more efficient and economical than one heavy one: this, however, may be due to improvement in the plan or execution, or it may be a surreptitious puff. But if the prediction be not verified as to macadam

road carriages, it is because the iron road has proved the better and cheaper road, and with its steam carriage, has superseded almost every line of stage coaches in England.

I submit, then, that the steam carriage has not been beaten; it is the iron road that has beaten the stone road. What this or that inventor may have failed to do, is of little moment; but as the failure of Garry, Hancock, and others, is often quoted as a reason for doubting the power of steam to work upon common roads with economy, it is but just to say, that they were subjected to prohibitory tolls, which the House of Lords refused to regulate, after the Commons had passed a bill to regulate them; and that the same body refused to extend the patents, which had nearly expired before the inventions became efficient, and really got a little into use. It was not horse power that drove them from the macadam roads, but the power of the land interest, represented in the House of Lords, and in the turnpike trusts. The same interest opposed railways, from the same motive, the fear that the price of horse feed, and the rent of land, would not continue to rise.

Railways may for a long time occupy the long lines of travel, where there is little occasion for frequent stoppages; but in the vicinity of great cities, the iron road will be the more convenient, agreeable, and economical. It will admit the stout burden wagon, at a speed of eight or ten miles, which will not render it liable to run off the road; and it will allow free course to the light passenger carriage, at railway speed; and should it leave the iron track, as the locomotive sometimes does, its wheels will not cut into the ground, and it will easily regain the road without injury.

There is a vague notion that steam power is enormously heavy. The weight of the broad gauge locomotives, is 156 lbs. per horse power. The tender with its load may be one-fourth as much, or the total weight of the power and the vehicle to carry it, is within 200 lbs. per horse power, even in those engines which are made for long endurance, and with little regard to lightness. It may be reasonably estimated that a horse power would not exceed the weight of a passenger; and that a carriage which is strong enough to carry twelve passengers when drawn by two horses, would carry at least ten, if it had steam power attached to it. This basis is estimated upon what has been done; a careful estimate based upon the strength of materials, and the power obtainable from fuel and water, shows, that the motive power, apart from the vehicle that bears it, need not weigh more than fifty pounds per horse power.

The question of manageability has been settled by the experiments of the English; they can be managed with more ease and precision than horses. There is no smoke, noise, visible steam, or other nuisance attending them. And, although they employed two, and sometimes three men upon each carriage, there is no doubt that one man is capable of doing all that is required upon the roads. The fuel and water are supplied at the stations, and so disposed that they are fed into the furnace and boiler without any attention from the conductor; and a gentleman will find it by no means unpleasant to manage his own carriage, which he can do from within, without the least exposure to the weather.

I have inquired of machinists as to what it would cost to construct the machinery for a carriage for four or six persons, and I find it would be

about seven hundred dollars. The interest on this sum, and an allowance for wear of double the amount in locomotives, with the expense of fuel, oil, etc., and all other expenses, would not amount to so much as it costs to keep one horse and his vehicle. It is therefore probable that private carriages will come into extensive use as roads improve. And the sooner the main roads are improved, the sooner will this convenience be within the reach of all industrious and economical persons.

Observations on Artificial Hydraulic or Portland Cement; with an Account of the Testing of the Brick Beam erected at the Great Exhibition. By Mr. G. F. White, Assoc. C. E.*

After detailing the experiments made by the late Sir Isambard Brunel, the paper noticed the peculiarities in the practice of the English and foreign engineers in the use of cements and limes. It was stated, that in England, the natural cements were plentiful, and the mode of construction being generally in brickwork, quick setting cements were preferred; whereas, abroad, the natural cement stones were, comparatively speaking, rare, and the use of bricks rather the exception than the rule. In some cases it was found, that even the best natural hydraulic limes did not set with sufficient rapidity in salt water, to do away with the necessity for using pozzalanos; and some of the attempts made at various periods to substitute artificial pozzalanos for the very expensive natural products of that nature, were then described. The unfavorable results of these attempts, and the manner in which M. Vicat explained them, were detailed. A sketch was then given of the course of investigation followed in England by Mr. Frost, and General Sir Charles Pasley, from which it appeared that, until the introduction of the Portland cements, no artificial compound had been discovered, which possessed the same, or greater powers of resistance than those of the natural cements. The advantages of the Portland cement were stated to be that it had nearly all the qualities of rapid setting presented by the natural materials of the same class; and, in addition, that as it was capable of supporting variable proportions of sand, it could be used as a mortar, the rate of setting of which might be modified at will, and the powers of resistance of which were stated to be much greater than those of either the cements or the limes thus replaced.

A general description of the manner in which the Portland cement was now manufactured, and of the methods of testing the article, were then given; and it appeared, that, after seven days, the cohesive strength of the neat cement was equal to about 100 lbs. on the square inch; and that after six months, this became equal to not less than 414 lbs. per square inch. M. Vicat had stated, in 1851, in a communication to the *Annales des Ponts et Chaussees*, that by the use of Portland cement alone, or what he termed "overburnt lime," it would be possible to form immense artificial blocks, capable of resisting the action of the waves and of the shingle upon the sea shore; an action which it was well known rapidly destroyed the natural cements, and the pozzalanic mixtures, whether of natural or artificial pozzalanos.

* From the London Journal of Arts and Sciences, July, 1852.

The several applications of the Portland cement as a concrete, as a mortar, and as a stucco, were then alluded to, and reference was made to the early failures in forming large artificial blocks; and an account was given of the mode now adopted in constructing them at Dover and Alderney harbors of refuge, and likewise of those employed to protect the extremities of the breakwater of Cherbourg. At Dover, the hearting of the piers, below high-water mark, was executed in blocks of concrete, composed of cement and shingle in the proportions of 1 to 10, and occupying about three-fourths of the volume of the separate materials measured in the dry state. Each block contained from 30 cubic feet to 120 cubic feet, and weighed from 2 tons to 7 tons. At Alderney, a species of concrete, composed of cement, sand, and shingle, was placed in a mould, with rubble stone, bedded irregularly in the mass; the proportions being about one part of cement to ten parts of foreign materials. At Cherbourg, the system adopted was to build immense blocks of rubble masonry of not less than 712 cubic feet, and weighing about 52 tons. These blocks were floated out from the places where they were constructed, and sunk as "pierre perdue;" but this had not on all occasions been able to resist the transporting power of the waves. The manner of using the cement was in the form of mortar, composed of one part of cement to three parts of sand.

It had been stated by M. Vicat, that the powers of resistance to compression absolutely required, in substances exposed to the action of the sea, must be at least equal to 40 lbs. per square inch, and of that to tension at least equal to 9 lbs. on the square inch. Now, the resistance of the artificial stone blocks, after an interval of nine months, was not less than 1700 lbs. per square inch, when the effort was one of compression, or than 200 lbs. per square inch, when it became an effort of tension, or little inferior to that of Portland stone itself.

Attention was called to the fact, that the Portland cement adhered more energetically to the Portland stone than to any other material. This degree of adhesion did not seem to depend so much upon the absorbent powers of the substances connected together by the cement, as upon some coincidence in the manner of their crystalization.

The applications of Portland cement to the purposes of stucco, for external works, were noticed. Its advantages were stated to consist in its agreeable color, without the intervention of paint or lime-white, its power of resisting frost, and its freedom from vegetation: all which were attributed to the close contact of its constituent parts, and to the surface being perfectly non-absorbent. For the same reason, it was asserted that the Portland cement was eminently adapted for the construction of cisterns and baths, and for the various descriptions of statues and fountains, &c., now made of artificial stone.

The paper concluded by a description of the experiments on the brick beam at the Great Exhibition of 1851: from which it was deduced that the strength of Portland cement, as compared with Roman cement, was in the ratio of $2\frac{1}{8}$th to 1. Attention was called to the several tables and diagrams, which were exhibited, illustrative of the various power of resistance of the cement under efforts of compression, extension, and tearing asunder.—*Proc. Inst. Mech. Engineers.*

AMERICAN PATENTS.

List of American Patents which issued from July 6th, to August 3d, 1852, *(inclusive,) with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improved Centre Square for Finding the Centre of a Circle;* Nathan Ames, Saugus, Assignor to Walter Bryent, Boston, Massachusetts, July 6.

Claim.—"What I claim as my invention is, 1st, The application to an instrument, substantially in the manner herein set forth, of a geometrical fact, viz: that any circle touching the sides of a right angle may be divided into two equal parts, by the line which divides the right angle into two equal parts.

"Secondly, the union of the above with the common "trying square," by means of the bar as described."

2. For an *Improvement in the Construction of Bridges;* Abel Bradway and Elijah Valentine, Monson, Massachusetts, July 6.

Claim.—"What we claim as our invention is, the combination of the string pieces with the posts, the cross joints, the saddles, the diagonal braces, and the ties of a bridge frame, in such manner that the said string pieces are enabled to move longitudinally under the influence of variations of temperature, or other cause, without injury to themselves, or to the parts with which they are combined, substantially as herein set forth."

3. For an *Improvement in Car Seats;* John Briggs, Boston, Massachusetts, July 5.

Claim.—"What I claim as my invention is, a car seat constructed with a double back, which can be folded up or unfolded, by means of the hinged arms, operating as above set forth; the two pieces which constitute the back being held together when open or raised up by the spring lips, substantially as above described."

4. For an *Improvement in Turning Engines;* James S. Brown, Pawtucket, Massachusetts, July 6.

Claim.—"What I claim is, the clasp, in combination with the slide and saddle, for the purpose of arresting the combined operation of the slide and the pattern when required.

"And I also claim the cylindrical nut, in combination with the standard and tool holder of the slide rest as described, by which the edge of the tool is brought to the proper position to co-operate with the pattern bar and slide rest, substantially as is herein set forth."

5. For an *Improvement in the Construction of Bridges;* J. B. Gridley, Brooklyn, New York, July 6.

Claim.—"I am aware that diagonal or inclined counter braces, differently arranged, have before been used; such, therefore, irrespective of their disposition and combination as specified, I do not claim; but what I do claim as my invention is, the upper and lower counter braces, inclining in reverse directions to one another, for either half of the span, as shown and described, and connecting the double diagonal main brace with the upper and lower chords united by tie timbers as specified, producing the important results herein set forth."

6. For an *Improvement in Hand Planes;* Birdsill Holly, Seneca Falls, New York, July 6.

"The nature of this invention consists, 1st, in certain improvements in the stock, and in the cap of the iron, which allow the width of the throat to be altered for different kinds of work.

"2d, In certain means, by which the cap of the iron is always caused to drop into its place without requiring any adjustment or setting."

Claim.—"What I claim as my invention is, 1st, the loop on the cap, in combination with the plane iron and the stem of the stock, in the manner substantially as described, to wit: the said loop fitting over or embracing the plane iron and stem, and allowing the iron to be secured between the cap and the stem, by means of a wedge, placed either between the back of the iron and front of the stem, between the front of the iron and the cap, or between the back side of the stem and back part of the loop, the three positions of the wedge forming three different widths of throat, as herein explained.

"2nd, Providing the cap with shoulders, which, when the cap is placed in the stock of

the plane, will fall on suitable resting pieces, provided in or upon the stock, substantially as described."

7. For an *Improvement in Patterns for Metal Hubs, &c.;* Jasper Johnson, Geneseo, New York, July 6.

Claim.—"Having described my improvement, what I claim as my invention is, furnishing the usual pattern with a shield, as herein described, whereby I am enabled more easily to draw the core and prevent chipping and breaking down thereof."

8. For an *Improvement in Portable Grain Mills;* Charles Leavitt, Quincy, Illinois, July 6.

Claim.—"What I claim as my invention is, forming the inner stationary cone with a cavity, (square or otherwise,) as described, for the purpose of readily securing the mill on the top of a post or stump, without the use of bolts or wedges, &c., as set forth."

9. For an *Improvement in Churns;* Norman B. Livingston, Portland, Indiana, July 6.

Claim.—"Having thus fully described the nature of my improvement in churns, what I claim therein as new is, the racks, grooves, and pinions, by which the shaft and beaters are caused to traverse the milk or cream, with a compound vertical revolving and reciprocating motion, after the manner and for the purposes described."

10. For an *Improvement in Railroad Car Brakes;* Wm. Montgomery, Roxbury, Massachusetts, July 6.

Claim.—"I do not claim the mere combination of the plates or surfaces, one of which shall be made to rub against the other and constitute a friction brake; but what I do claim as my invention is, my improved brake, composed of three or any greater number of plates or disks, arranged side by side and on a shaft, and having some one or more of them connected with the shaft, so as to be revolved by it, and the others held stationary, so as not to be revolved, and the whole, except one of the outer ones, made to slide endwise on the shaft, and combined with an apparatus or means of pressing them towards and against one another, substantially as specified.

"I also claim the combination of the cross rods, with their friction plates and axle, for the purpose of sustaining the axle in case of fracture of it, as specified."

11. For an *Improvement in Processes for Defecating Sugar;* Robert and John Oxland, England, July 6, 1852; patented in England, May 15, 1851.

"These improvements consist in the combining of acetate of alumina, aluminate of lime, and phosphoric acid, for defecating saccharine liquids, or solution of sugar, and for removing their color."

Claim.—"Having thus described the nature of our improvements, and the manner of performing the same, we would have it understood that we do not confine ourselves to the details as herein given, nor to the phosphates mentioned, as others may be substituted; what we claim is, the use of aluminate of lime, in combination with the super-phosphate of alumina, or of lime, or with the phosphoric acid, for clarifying cane juice or syrups, as set forth: but we disclaim the use of phosphoric acid, except in combination with the above named bases."

12. For an *Improvement in Cutter Heads for Planing;* James M. Patton and Wm. F. Fergus, Philadelphia, Pennsylvania, July 6.

Claim.—"What we claim as our invention is, our improved elliptical reducing and planing instrument, composed of obliquely acting cutters, secured to an elliptical plate in such a manner that the periphery of the said plate will gauge the depth of the action of the cutters, and also serve to hold down the material operated upon, substantially as herein set forth."

13. For an *Improvement in Cordage Machines;* John W. Peer, Schenectady, New York, July 6.

"The nature of my invention consists in the combination of the scrolls and pinions, with friction pulleys, thereby producing regular feed motion, with an uniformity and equality of strain on each strand of rope, whilst laying or forming."

Claim.—"Having thus described the construction and operation of my machine, what I claim is, the use of grooved scrolls, and their combination with pinions, and grooved rollers, and friction rollers, or equivalents for such friction rollers, to create a regular feed motion and equality of strain, whilst laying or forming, in a rope, twine, or cordage ma-

ine; the whole being constructed in the manner and for the purpose substantially the ıme as described."

4. For an *Improvement in Double Acting Doors;* William Rippon, Providence, Rhode Island, July 6.

Claim.—"What I claim as my invention is, the manner substantially as herein described f arranging vertical and horizontal adjustable slats along the front, top, and back edges f the door, for the purpose of allowing the door being opened in either direction, in or ıt; said slats being made to operate in the manner herein specified, by means of the door, vers, or their equivalents, and springs; the whole being constructed and arrranged in the ıanner herein set forth."

5. For an *Improved Mode of Grinding Puppet Valves while the Engine is in Motion;* Enos Rogers, City of New York, July 6.

"The nature of my invention consists in a combination of certain mechanical elements,) adjusted and applied to the valves of steam engines while in use, that the valves therey are caused to rotate slowly upon their seats during the period of time that they remain ıut."

Claim.—"What I claim as my invention is, the valve provided with spindles free to ırn on their lifters, in combination with mechanical devices, substantially such as are erein described, which rotate said valves when down on their seats, but do not act on ıid valves when rising or falling; the whole acting substantially in the manner and for ıe purposes described."

6. For an *Improvement in Machines for Rubbing Stone;* Pleasant E. Royse, New Albany, Indiana, and Ira Reynolds, Republic, Ohio, July 6.

Claim.—"We are aware that stationary or fixed wheels have been placed in the centre f stone rubbing machines, with cranked pinions revolving on their own axis and around ıe said fixed wheels as a common centre; therefore, we do not wish, or intend to claim, ıe arrangement of stationary or fixed wheels, around which the pinions revolve, to give ıotion to the arms and rubbers; but what we do claim as our invention is, the arrangeıent of a revolving centre driving wheel, with a series of stationary crank shaft pinions ıvolving on their own axis, whether in combination with the cranks or stationary pins,) constructed and arranged upon a radial line, as to give the arms and rubbers a rotary r compound elliptic rotary motion, for the purposes herein shown and set forth."

7. For an *Improved Combination of Cutters for Threading Wood Screws;* Thomas J. Sloan, City of New York, July 6.

"The nature of my invention consists in combining the operation of forming the threads f wood screws, by means of the burr cutter, with the operation of finishing and smoothng the thread, by means of a chaser, the screw blanks being in succession shifted from ıe operation of the burr cutter, where the thread is cut and formed, to the chaser, where ; is finished, thus combining the advantages of both systems."

Claim.—"I do not wish to limit myself to the mode of construction of the various parts, r their arrangement, as they may be varied to a great extent, without changing the priniple or mode of operation of my invention; what I claim is, the method, substantially as erein specified, of cutting away the mass of the metal to form the thread, by means of a urr cuttter, in combination with the method, substantially as specified, of finishing and moothing the thread, by means of the chaser, as set forth."

8. For an *Improvement in the Thermostat for Regulating Heat;* Thomas J. Sloan, City of New York, July 6.

Claim.—"What I claim as my invention is, the application of the physical priniple of the expansion and contraction of substances by varying degrees of heat, to egulate and control a mechanism, applied to operate a damper, register, valve, ventilator, r other equivalent device, which mechanism is actuated or propelled by some independent ıotor, substantially in the manner and for the purpose specified."

9. For an *Improvement in Pneumatic Spring;* Elijah Ware, Roxbury, Massachusetts, July 6.

Claim.—"Having thus described my improvements, what I claim as my invention in an ir car spring, in which the piston operates upon the disk of rubber or other elastic substance hich forms one side of the air chamber, is, the combination of the movable diaphragm,

constructed of the pieces, operating substantially as herein above described, with the rings placed loosely on the same, for the purpose herein set forth."

20. For *Improvements in Planing Machines;* William Watson, Chicago, Illinois, July 6.

Claim.—"Having thus described my improvements, what I specifically claim therein as new is, a reducing plane, composed of a series of oblique irons, arranged substantially as herein set forth.

"I also claim the combination of the before claimed reducing cutters with smoothing cutters, arranged substantially as herein set forth."

21. For an *Improvement in Railroad Car Brakes;* Lafayette F. Thompson, Charlestown, and Asahel G. Bachelder, Lowell, Massachusetts, Assignors to Henry Tanner, Buffalo, New York, July 6.

Claim.—"What is claimed by us is, to so combine the brakes of the two trucks with the operative windlass or their equivalents, at both ends of the car, by means of the vibrating lever, or its equivalent, or mechanism essentially as specified, as to enable the brakeman, by operating either of the windlasses to simultaneously apply the brakes of both trucks, or bring or force them against their respective wheels, and whether he be at the forward or rear part of the car."

22. For an *Improved Screw Threading Machinery;* Cullen Whipple, Assignor to the New England Screw Company, Providence, Rhode Island, July 6, 1852; ante-dated May 15, 1852.

Claim.—"What I claim as my invention is, a fusee, threading cutter for threading screw blanks, substantially as herein set forth.

"I also claim the arrangement of the cutter and blank, in such manner that the adjacent portions of their peripheries shall move in opposite directions during the operation of threading, so that the metal may be cut from the grooves in the blank from the bottom outwards, to allow the chip to be freely discharged, substantially as herein set forth.

"I also claim the combination of the vibrating feeding trough and screw driver, arranged in such manner that when the driver is pushed forward to turn a blank, while being threaded, an unthreaded blank may lie in the trough upon the driver, ready to drop into place before it, the instant it is drawn back, to allow the previous blank to be withdrawn from the cutter.

"I also claim the combination of the vibrating arm, or its equivalent, to detach the head of a threading blank from the bit of the screw driver, with a discharging punch, or its equivalent, to eject the threaded blank from the rest, the two thus operating, insuring the discharge of one blank before another is presented.

"Lastly, I claim a spring, or the equivalent thereof, in the mandrel of the screw driver, substantially as herein set forth, to impart to the bit of the screw driver, a slight yielding pressure against the head of the blank, until it winds and enters the nick thereof, in combination with the lever and cam, which afterwards apply to the driver a positive motion to keep it engaged with the blank while the latter is turned to be threaded, substantially as described."

23. For *Improvements in Machines for Tonguing Boards;* Samuel Albro, (late) Buffalo, New York, July 13.

"The nature of my invention consists in the making of a flaring stock, for the free escape of the shavings, and in combination therewith a series of cutters, so arranged as to cut a shaving both from the side and shoulder of the rebate, and giving to the said cutters a double grade, so as to be adjustable both to the side and shoulder aforesaid."

Claim.—"Having thus fully described my invention in tonguing, what I claim therein as new is, in combination with a flaring stock, substantially as described, the arranging of a series of cutters therein, so formed as to take the shavings from the sides and shoulders of the rebate, substantially as described; and this I claim, whether said cutters have a double or single graduation, so that I attain the result herein set forth, by substantially the arrangement and combination herein described."

24. For an *Improved Instrument for Driving Nails in Difficult Places;* Seth P. Carpenter, Milford, Massachusetts, July 13.

Claim.—"What I claim as my invention is, the instrument as constructed, of a combination of a tube, two or more springs, one or more holding points, and ramrod, and made to operate substantially as herein before specified."

25. For an *Improvement in Cast Iron Caissons;* James P. Duffey, Philadelphia, Pennsylvania, July 13.

Claim.—"Having thus described my invention, what I claim as new is, the method of bracing rectangular or other shaped metallic boxes, by means of the diagonal braces and rods, the braces and rods being arranged in the manner substantially as set forth."

26. For an *Improvement in Threshing Machines;* Joseph G. Gilbert, City of New York, July 13.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, the manner herein described of constructing skeleton threshing cylinders, viz: by bolting or welding to the arms, which are attached to the shaft, any suitable number of branches, which, together with the arms, present their edges to the line of motion, and are provided with serrated ends, substantially in the manner and for the purpose set forth."

27. For an *Improvement in Shingle Machines;* Furman Hand, Jr., Chicago, Illinois, July 13.

Claim.—"Having thus fully described my invention, what I claim as new is, so combining and arranging the riving knife and the shaving knives in their ways, as that, after the shingle has been separated, or nearly so, from the bolt, it will be carried forward by the carriage to the shaving knives, where it is finished, and so that the riving knife shall remain stationary, until the shaving knives have taken firm hold of the rived shingle; the whole being operated by the means substantially as herein described.

"I also claim, in combination, the double carriage, one moving on the top or over the other, and so arranged that one shall feed up the riven shingle to the knives, and the other shall carry back the bolt, at each operation of the machine, sufficiently far to cut off one shingle therefrom; the whole being operated substantially in the manner described."

28. For an *Improvement in Railroad Car Brakes;* Joseph P. Martin, Philadelphia, Pennsylvania, July 13.

"The nature of this invention consists in operating on the upper ends of the levers which move the rubbers of railroad car brakes, by longitudinal jointed bars, moving in guides at the will of the engineer, when the train is in forward motion, and projecting beyond either end of the car; the inner one of said bars being held in a suspended state, by means of a chain passing over a roller above the same, and around the shaft of the friction wheels, resting on the shaft of the wheels of the car, in such a manner as to enable the inner end of said inner bar to descend and clear itself of contact with the rubber levers, after the train has been checked, in order to back the same, and to be raised to its former position for acting, after the train has been moved a certain distance ahead."

Claim.—"What I claim as new is, the method of raising the forked or cam hook end of the jointed bar to a horizontal position, immediately in advance of the pin, at the upper end of the rubber levers, so that it will act upon the same when forced back, and enabling it to detach itself and descend to an inclined position, when it is desired to back the train, by means of the friction wheels, whose shaft moves in slots, and whose peripheries rest on the car wheel shaft or axle and chain, attached to the shaft of the friction wheels, and passing over the roller above the jointed bar, to which it is attached, arranged and operated as herein described, whether the said jointed bar be attached to the sliding bar represented, or to the ordinary bumper of the car."

29. For an *Improvement in Churns;* John McLaughlin, Goshen, Ohio, July 13.

Claim.—"I am aware that oscillating churns have been used before; therefore this I do not claim: but what I do claim as my improvement is, mounting the churn tub or barrel, composed of two sections, and containing a grate at their junction, within a clasp band, united to pivoted pendent bars, whereby, through means of a lever, the barrel is so operated as to present its ends uppermost, the one after the other, by which the milk or cream is carried up by one section, and allowed to descend through the grate, as described."

30. For an *Improvement in Shingle Machines;* Robert L. Noblet, Haverford, Pennsylvania, July 13.

Claim.—"Having thus fully described my invention, what I claim therein as new is, making the double racks in segments, one of which is stationary, and the other adjustable, for the purpose of cutting shingles of various thicknesses at butt and point, with the same racks, substantially as described."

31. For an *Improvement in Benzole Lights;* Henry M. Paine, Worcester, Massachusetts, July 13.

Claim.—"I do not lay claim to any particular apparatus; but what I do claim as my invention or discovery is, the mixture of alcohol, benzole, and water, with such proportions of water as shall render the liquid milky in appearance, and passing air through the same, substantially as herein set forth. I do not confine myself to the exact proportion of water named in the specification, but to cover the results herein named."

32. For an *Improvement in Corn Shellers;* William Reading, Washington, District of Columbia, July 13.

Claim.—"Having thus fully described my improved corn sheller, what I claim therein as new is, the within described combination of a toothed or flanched cylinder, with an enclosing cylindrical casing, of such proportions respectively, and so arranged, the one within the other, as to leave an amount of space between the two which shall cause the cobs and ears to clog and accumulate therein, during their passage through the same, and form an elastic self-adjusting bed, for the spirally arranged teeth or flanches of the shelling cylinder to act in concert with, in place of the stationary bar or rest, which is employed in all other cylindrical corn shellers."

33. For an *Improvement in Cast Iron Car Wheels;* Hiram H. Scoville, Chicago, Illinois, July 13.

Claim.—"Having thus described my improved car wheels, what I claim as new therein is, the double curved arms interlacing one another, and uniting the opposite edges of the rim and hub, substantially as specified."

34. For an *Improvement in Bedstead Fastenings;* Isaac A. Sergeant, Hamilton, Ohio, July 13.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, forming the tenon portion of a bedstead joint by catch-studs or pins, having heads projecting rectangularly from tangs, so tapered and notched, that by being slipped forcibly past each other, they can be made to interlock within a socket, drilled for them, across the radial or bastard grain of the rail tenon, and be made, by their thus interlocking, to resist any tendency to be drawn out from the rail, and by the compressure of their heads, to prevent the rending apart of the fibre of the tenon, and can be made of such dimensions that a pin of adequate strength can be inserted within the limits of an ordinary bedstead tenon."

35. For an *Improvement in Alarm Clocks;* Jonathan S. Turner, New Haven, Connecticut, July 13.

"My improvement consists in so constructing the alarm part, that it will give alarms for eight days (or more) with once winding, and so that it will give but one alarm in twenty-four hours, or while the hour hand is making two complete revolutions."

Claim.—"What I claim as my invention is, the combination of the double notched cam, with the locking apparatus, with their appendages, and giving more than one alarm with once winding, when the whole is constructed, arranged, and combined, substantially as herein described."

36. For an *Improvement in Cotton Presses;* Jacob G. Winger, Vicksburgh, Mississippi, July 13.

"The nature of my invention consists in constructing a press with two right hand and one left hand screws, or two left hand and one right, as herein after described, so as to give three times the progressive motion to the follower, in the same time, that would be effected by a single screw; and so arranging it, that the entire weight of the frame and chamber of the press is made effective to aid in pressing the bale."

Claim.—"Having thus described my invention, what I claim therein as new is, the arrangement and combination of the screws with the top and bottom cross beams of the frame, and the cross head of the follower, by which the follower and bed plate are made to press the bale from top and bottom, and the distance traveled by the follower towards the bed plate is three times that of the frame (to which the power is applied) over the screw.

2d, I claim making the weight of the press an auxiliary power, by resting it entirely on the lower screw, so that in pressing the bale, the frame is traveling down the screw, as on an inclined plane."

37. For an *Improvement in Seed Planters;* Joshua Woodward, Haverhill, New Hampshire, July 13.

Claim.—"Having thus fully described my improved seeding apparatus, and the various modes I contemplate modifying it, as required by law, what I claim therein as new is, the hooked rod, constructed and arranged substantially in the manner and for the purpose set forth."

38. For an *Improvement in Door Locks;* Marcus R. Stephenson, Assignor to Edwin Holman, Boston, Massachusetts, July 13.

Claim.—"I claim the combination of the cover plate and its arbor, with the slide for carrying the bitt plate, and a contrivance applied to the said arbor, and made to actuate the said slide and bitt plate, all constructed and made to operate together substantially as herein before described.

"And I also claim the improvement termed the circular arc lip, in its combination with the cover plate, and made to project down between the bitt plate recess and the tumblers, when the bitt plate hole or entrance of the cover plate uncovers the bitt plate recess, either in whole or in part, all substantially as herein before explained."

39. For an *Improvement in Fire Engines;* Orville G. Adkins, Oswego, New York, July 20.

Claim.—"What I claim as my invention is, the mode herein described, of drawing the resistance towards the fulcrum of the lever to which the power is applied through its entire descent; thereby lengthening the long arm, and shortening the short arm of the lever, substantially as described."

40. For an *Improvement in Car Seats;* William S. Bass, Cambridge, Massachusetts, July 20.

"The object of my improvements is, to secure an easy and comfortable car seat, so constructed as to admit of a person's reclining as far back as is desirable, while at the same time it will occupy no more room than those which have heretofore been in common use."

Claim.—"Having thus described my improvements, what I claim as my invention is, a car seat, to the bottom of which are jointed a back and leg support; the said back and leg support being placed and held at any desired angle, by arms fastened to the side arms in any desirable way, as above set forth."

41. For an *Improvement in Ploughs;* Neri Blatchly, Windsor, New York, July 20.

Claim.—"What I claim as my invention is, the arrangement of the beam of a plough with respect to the irons, and the bending of the standard towards the land, and having its line of direction parallel with that of the land side, in the manner and for the purposes herein set forth."

42. For *Improvements in Machines for Shaving Shingles;* Abel Bradway, Monson, Massachusetts, July 20.

Claim.—"Having thus fully described my improved machine for dressing riven shingles, what I claim therein as new is, the combination and arrangement of the yielding knives, the sliding shingle patterns, the roller, the elastic bed, the plate, and box, substantially in the manner and for the purpose as herein set forth."

43. For an *Improvement in Method of Converting Reciprocating Rotary into Reciprocating Rectilinear Motion;* Alfred Carson, City of New York, July 20.

Claim.—"I do not claim the use of pulleys, chains, and guides, for the purpose of converting rotary reciprocating into rectiliner reciprocating motion; but what I do claim as my invention is, slotting or forking the rods, and letting their two sides into grooves in the periphery of the pulley, and connecting the rods and pulley by three chains, two of which connect with each rod on opposite sides, and pass in one direction around the pulley, and the other connects with each rod within the slot or fork, and passes in the opposite direction round the pulley, for the purpose of guiding and directing the rods, and dispensing with the ways and cross heads ordinarily made use of for this purpose; the several parts operating substantially as and for the purpose set forth."

44. For an *Improvement in Machines for Dressing Stone;* Robert Eastman, Concord, New Hampshire, Assignor to Capt. Seth Eastman, Washington, District of Columbia, July 20.

"The nature of my invention consists in dressing or working the stone or other material

by forcing the chisels, picks, or cutters against it, by a positive crank motion, so that they cut with a steady positive motion, under the combined action of the crank, instead of cutting with a blow."

Claim.—"What I claim as new in the within described machine for dressing stone, and for facing, reeding, fluting, and cutting mouldings upon stone, is the operating of one or more chisels or tools, by a crank or cranks, or their equivalents, which, by their continued action upon said tools, thrust or force them against the stone or other material to be worked, substantially as described."

45. For an *Improvement in Cruppers for Harness;* John J. Flack, Joliet, Illinois, July 20.

Claim.—"What I claim as my invention is, the construction of a crupper, as herein described, by means of which, in taming or subduing horses, the tail of the horse may be kept in a desired position, without the necessity of resorting to the painful and injurious operation of nicking or pricking, and the pulleys, and to be used for the same purpose, when riding or driving the horse."

46. For an *Improvement in Grain and Grass Harvesters;* Eliakim B. Forbush, Buffalo, New York, July 20.

Claim.—"I claim as my invention, 1st, an open spaced guard finger with an inside surface, or middle finger, for the cutting tooth to cut against, substantially as herein described.

"2d, I claim the construction of a clamp of two parts, which will hold the finger bar, where desired, without bolts passing through the finger bar, arranged as herein set forth.

"3d, I claim the construction of a mould board with two upright posts, which posts pass through proper apertures in the frame of the machine, and are free to move up or down, according to the varying surface of the ground, and sustain the mould board forward of the cutter bar, on an angle sufficient to move the mown grass which may be forward of the finger bar to the inside of the clamp, substantially as herein described.

"4th, I claim the arrangement and combination of a right angled stanchion, made of wood or metal, with a pivotal motion on the frame work of the machine, and supporting upon its upright part a crooked lever made of wood or metal, with a pivotal motion on the said stanchion, to which lever is attached a rake; by the combination and operation of these two pivotal motions of the stanchion and lever, as set forth, a direct line motion may be given to the rake where needed, as also a circular motion, so that a person may remove the grain from the platform in bundles, and sit or stand on the machine near the driving wheel, as herein described."

47. For an *Improvement in Railroad Car Brakes;* Wm. Hall, North Adams, Massachusetts, July 20.

Claim.—"What I claim as of my invention is, the combination of the sliding detached lever with the main lever and the connecting rods, so as to operate essentially in the manner and for the purpose as herein before specified."

48. For an *Improvement in Rice Hullers;* Clark Jacobs, Brooklyn, New York, July 20.

Claim.—"I do not claim the use of india rubber surfaces for hulling the rice, such having been used before; but what I do claim as my invention is, the use of a vulcanized gum elastic, or rubber, or its equivalent, in combination with a stone or other equivalent non-elastic rubbing surface, for hulling rice, substantially in the manner herein set forth.

"I also claim the manner of constructing the rubber of three substances of different qualities, viz: the metallic disk, leather disk, and gum elastic, or gutta percha disk, by which firmness, elasticity, and durability are combined, substantially as herein described."

49. For an *Improvement in Grass Harvesters;* Jesse S. and David Lake, Smith's Landing, New Jersey, July 20.

Claim.—"What we claim as our invention is, 1st, The clearer as above described.

"And lastly, we claim the coupling the wheel to the shaft, with universal joint, constructed with toggle joint arms, to admit of a vertical motion, and with gimble ring, to allow of a rolling or wabbling movement, without affecting its rotary motion, when combined and arranged for the purpose and in manner above described."

50. For an *Improvement in Grass Harvesters;* Wm. Manning, South Trenton, New Jersey, July 20.

Claim.—"Having thus fully described my invention, what I claim as new is, suspend-

ing the cutting head and front part of the machine, whereby I dispense with front wheels, by constructing the frame as described, and attaching the cutting head to the hames of the harness, in the manner and for the purpose herein fully set forth."

51. For *Improvements in Sewing Machines;* Charles Miller, St. Louis, Missouri, July 20.

"This invention relates to that description of sewing machine which forms the stitch by the interlacing of two threads, one of which is passed through the cloth in the form of a loop, and the other carried by a shuttle through the said loop; it consists, 1st, in an improved stop motion, or certain means of preventing the feed or movement of the cloth, when by accident the thread breaks or catches in the seam; and, 2d, in certain means of sewing or making a stitch similar to what is termed in hand sewing, 'the back stitch.' "

Claim.—"Having fully described my invention, what I claim as new is, 1st, The stopping or prevention of the operation of the feed, substantially as herein described, when the thread breaks or is otherwise prevented from forming a loop, by attaching the stud or its equivalent, through which the feed lever is operated upon by the feeding cam, to a lever; the said lever being subject to be operated upon in such a manner as to withdraw the said stud, or equivalent, from the operation of the cam, by a sliding piece attached to the picker, which drives the shuttle forward for filling; the said sliding piece requiring to be caught and moved by every loop, to prevent its operation in the said lever.

"2d, Sewing or making the back stitch by folding or bending the cloth or material over the edge of a guide plate or any other suitable edge, and passing each loop through the cloth or material on each side of the said bend and each succeeding loop through, in advance of the preceding one, and half-way between the two preceding perforations, substantially as herein set forth."

52. For an *Improvement in Grain Separators;* Cyrus Roberts, Belville, Illinois, July 20.

Claim.—"Having thus described my improvements in grain separators and cleaners, what I claim therein as new is, the combination of the adjustable crank for vibrating the separating trough, with the adjustable tracks on which the jumping roller runs, which shakes the trough up and down, whereby the conveyance of the straw may be accelerated or retarded, without affecting the vertical shaking of the straw.

"I also claim the adjustable angular rails, constructed and arranged in the separating trough, in the manner and for the purposes herein set forth.

"I likewise claim the method herein described, of relieving the winnowing apparatus of a portion of the work, by separating, by means of a screen, arranged substantially as herein set forth, such impurities as will pass through it before the grain is delivered to the winnowing apparatus."

53. For an *Improvement in Railroad Car Brakes;* John Houston and Ebenezer Ross, Manchester, New Hampshire, July 20.

Claim.—"What we claim as our invention is, the arrangement, substantially as set forth, of the levers, rods, and vertical shaft, applied to each truck of a railroad car, in combination with the method of connecting the levers by means of the links, so that if one or more of the links or bars should break, so as to render part of the brakes useless, the remainder are still serviceable for the purposes intended."

54. For an *Improvement in Machines for Rubbing Stones;* Pleasant E. Royse, New Albany, Indiana, July 20.

Claim.—"I do not claim the separate employment of a rotary rubber and blocking tables, as such are in common use; nor do I claim, of itself, giving the rubbers a separate motion, in addition to their revolving one, by means of pinions gearing into a fixed wheel, and through cranks and connecting rods, serving to operate the rubbers, as such has before been done; but what I do claim as my invention is, the combination of parts herein specified, for rubbing and polishing marble or other stone, consisting of rubbers, having in addition to their revolving travel on the faces of the stones being rubbed or polished, a motion in and out from the centre shaft, not in a radial, but in a winding, twisting, or curvilinear direction, produced by the cranks and rods as shown and set forth; the said rubbers being held in clamps, so hung or connected, as that the rubbers, by their weight, will adjust themselves to the stone, without rendering it necessary to pack up the latter, and for the further advantages specified."

55. For an *Improvement in the Water Pipes of Tuyeres;* Peter Sweeney, Buffalo, New York, July 20.

"The nature of my invention consists in combining with the circulating water pipe for cooling the tuyere, another pipe, by which I am enabled to shut off the circulation of water and blow the water out of the circulating pipe; the object of my invention being to avoid the evils which arise from the freezing of the water in the circulating pipe of the tuyere in cold weather."

Claim.—"What I claim is, the combination of the pipe, H, with the circulating pipe, P, V, Q, so connected that H may be removed from, or form a water tight joint with P, V, Q, whereby I am enabled to blow all the water out of the latter, and at the same time to shut off its communication with the cistern, in the manner and for the purposes described."

56. For an *Improvement in Railroad Car Coupling;* James Turner, East Nassau, New York, July 20.

Claim.—"What I claim as my invention is, the transverse incline bar, in combination with the coupling pin and link, the pin resting on the incline bar, and being raised clear of the link, by passing up the inclines on the said bar, as it (the pin) moves sideways, substantially as herein described."

57. For an *Improvement in Preparing Zinc from the Ores;* Henry W. Adams, City of New York, July 27.

Claim.—"Having thus fully described the nature of my invention or discovery, and shown the method in which it may be accomplished, what I claim therein as new is, the process of manufacturing metallic zinc, in a state of impalpable powder, by the cooling agency of steam, substantially in the manner herein set forth."

58. For an *Improvement in Machines for Forming Button Backs;* James C. Cooke, Waterbury, Connecticut, July 27.

Claim.—"What I claim as my invention is, the jointed clamps, and the tongue, to form the eye, when combined with the slide with its stationary and movable jaws, when the movable jaw and slide are worked by a jointed lever to feed the wire, when they are constructed and made to operate substantially as herein described.

"I also claim the die for punching and forming the button back, composed of the punch and bed, when combined with the slide and feeding cylinder, when constructed and operated substantially as herein described.

"I also claim the jointed fingers for receiving the formed and punched back, and conveying it to and placing it on the eye, when combined with the setting or riveting punch, when they are constructed, combined, and arranged, and made to operate, substantially as herein described."

59. For an *Improvement in Saws for Sawing Stone;* Albert Eames, Springfield, Massachusetts, July 27.

"The nature of my invention consists in making the blade with the middle part of its thickness, of lead or other soft substance, so that sand shall become imbedded into it, and remain there during the operation, to act upon, and break down, or cut away the stone, whilst the sides or edges, which are made of steel or iron, or other hard metal, will cut down and keep the kerf of the proper width, and prevent the lead or other soft substance, from spreading out or yielding."

Claim.—"What I claim as my invention in the making of blades for cutting stones is, the employment of lead, or its equivalent, between and in combination with the hard metal sides, substantially as specified."

60. For an *Improved Churn and Butter Worker;* Orsamus R. Fyler, Brattleborough, Vermont, July 27.

"The nature of my invention consists in combining revolving floats or dashers, with stationary posts, between which the dashers revolve."

Claim.—"What I claim as my invention is, 1st, the combination, in a cylindrical or tub churn, of floats or paddles, attached to a revolving axis, with stationary posts standing near the axis of the churn, combined and operating in the manner and for the purpose above specified.

"2d, The combination of dashers, or paddles, broad at their ends, with posts small at each end, and large in their middle portions, combined and operating in the manner and for the purpose above specified."

1. For an *Improvement in Fastenings for Harness;* Thomas Henderson, Harford County, Maryland, July 27.

Claim.—"Having thus fully described my invention or improvement, I wish it to be nderstood that I do not claim, in general , the use of a crooked lever and ring, for iese have been applied before to this purpose; but I do claim as new, the use of this pecuir kind of crooked lever or hook, described above, in which the fulcrum and centre of otion are at the short end, and the point of resistance at the curve and in a straight line ith the fulcrum and other end, thereby effecting the desired object within itself, and withit the combined aid of plate, spring, rivet, or other fixture; whether the same be applied the fastening of hames, as described above, or to connecting the ends of chains, as in the .se of chains usually fastened across the middle of wagon bodies, or to any similar purpose."

2. For an *Improvement in Duplex Escapements;* Charles E. Jacot, City of New York, July 27.

Claim.—"I do not claim any of the parts herein described or shown; nor do I claim the iplex escapement; but what I do claim as new and of my own invention is, the conruction and arrangement of the escapement wheel with three points and pins to take ie arm on the balance axis; the whole being constructed and operating substantially as escribed and shown."

3. For an *Improvement in Seed Planters;* Adam Kraber, York, Pennsylvania, July 27.

Claim.—"What I claim as my invention is, the combination of a series of stationary ombs, secured to the bottom of the hopper, near the orifices, through which the grain is scharged with a corresponding series of rotating teeth, secured to a cylinder or roller, iat revolves within the hopper, in the manner and for the purposes herein set forth.

"I also claim the combination of the cross bar, and its links and levers, with the draft irs of the shares, whereby the whole series of shares can, at will, be raised and depressed, hile the machine is in motion, and the weight of the whole machine is brought to bear pon any tooth that may tend to run out, in consequence of meeting with hard soil, while, t the same time, an even depth of furrow is maintained by the wheels, and the weight of ie frame taken off the shares, except when some one of them tends to run out, as herein set orth; but I make no claim to any arrangement of mechanism, for holding the teeth or iares in the ground, when the pressing bar acts upon the teeth through the medium f springs."

4. For an *Improvement in Soaps;* William M'Cord, City of New York, July 27.

Claim.—"I am well aware that "fuller's earth" being used for a soap, from time imiemorial, also of various clays having been used for detergent purposes; I am also aware iat ammonia has been employed in soap, and a patent has been issued, in which it forms ne of the ingredients; but in all cases, so far as I have seen it used, it has never been eld in good combination with the other ingredients in the soap, but has, owing to its olatile nature, soon evaporated. As combined with the clay, by my process, the amionia is retained in the soap, and does not evaporate. What I therefore claim is, the comination of ammonia, or carbonate of ammonia, with kaolin, or other equivalent aluminous iinerals, in the composition of a soap, substantially as herein set forth."

5. For *Improvements in Railroad Track Clearer;* Simeon Minkler, Chazy, New York, July 27.

Claim.—"I do not claim the grapples which are attached to the engine, car, or carriage, nd embrace the top flanch of the rail; but what I do claim is, keeping the said grapples losed upon the flanch of the rail, by the collar which drops over their joints, and opening he same by chains, or their equivalents, attached to the said collar and to the grapples, inder the control of a person on the engine, car, or carriage, said chains or equivalents ifting the collar, so as to leave the grapples free, and then opening them, substantially as ierein set forth."

6. For an *Improved Block for Stretching Coats;* Samuel M. Perkins, Springfield, Pennsylvania, July 27.

Claim.—"Having now described my invention, what I claim is, the use of the seamless oat stretcher, made in two halves and joined together by hinges at their back edges, and iaving permanent or adjustable arms attached thereto, and hooks for holding the edges f the cloth, while stretching, spring hook, or catch and pin, for holding the halves of the iachine together, and steadying pins, in the face of the two halves, in combination thereith, substantially as set forth."

67. For an *Improvement in Railroad Car Seats;* Samuel M. Perry, City of New York, July 27.

Claim.—"What I claim as my invention is, to so combine the back with the two end frames by means of bars jointed to it, one or two studs, and one or two series of notches or equivalents therefor, that the said back (when not a reversible one) may be raised and inclined in various positions, so as to not only support the back but the head of a person at the same time.

"And I claim making the back reversible by means of two series of notches, and two sets of studs, or equivalents, the same being arranged on opposite sides of the chair, and made to operate as specified.

"And in combination with the back made to raise and be inclined, by contrivances substantially as specified, I claim the improvement of making each bar with a rack or racks of teeth, or succession of notches, to be set on the pin, in the manner and for the purpose as specified."

68. For an *Improvement in Mortising Machines;* William C. Shaw, Madison, Indiana, July 27.

"The nature of my invention consists in providing the machine with suitable mechanism, for the purpose of enabling the operator to turn the chisel by means of the machinery employed for the purpose, and not by hand, as is commonly done."

Claim.—"What I claim as my improvement is, the method I employ of turning the mandrel that contains the mortising chisel, by means of the collar on the mandrel, springs, catches, shifting piece, friction rings, and pinion, all in combination for the purpose heretofore mentioned and set forth in the foregoing specification."

69. For an *Improvement in Lamps;* Charles Siedhof, Lancaster, Massachusetts, July 27.

Claim.—"What I claim as my improvement is, the open slide tube, as combined with the supply reservoir of a lamp, constructed and made to operate substantially as described: the object of such tube being not only to maintain the oil at a constant level around the wick, but to enable a person to regulate the height of such level at pleasure."

70. For an *Improvement in Graduated Cutters for Cloth and other Substances;* Halsey D. Walcott, Boston, Massachusetts, July 27.

"This improvement consists in making the bed longitudinally adjustable, in relation to the cutter, (or vice versa,) so as to vary the length of the cutting edge, which shall come in contact with the bed, and consequently the length of the incision that will be made by them."

Claim.—"What I claim as my invention is, the employment of a cutter and bed, or their equivalents, made adjustable in relation to each other, in the direction of the cutting edge. for the purpose of varying the length of the cut, substantially in the manner herein described."

71. For an *Improvement in Compounds for Uniting Steel and Iron;* Boyd C. Leavitt, Assignor to Joseph H. Bishop and H. Libbey, Newport, Maine, July 27.

Claim.—"I wish it understood I do not claim the use of crude borax, either pulverized or not, for the union of metals, as this has been used for the purpose by others; but it does not insure a perfect union, and cannot be relied upon with any degree of certainty, and great loss of time and material often occur, as a ready separation of the two, even after a seeming union, and the particular work seems complete, and ready for the use intended; but what I do claim as my invention or discovery is, the mode and manner of calcining and preparing the crude borax, and compounding the same afterwards, with the carbonate of ammonia, and in the proportions above set forth and described, and the mode of applying or using it, or any other substantially the same, and which will produce the intended effect."

72. For an *Improvement in Brooms;* Cyrus T. Moore, Assignor to Friend S. Noyes, Concord, New Hampshire, July 27.

Claim.—"What I claim as my invention is, 1st, securing the material of the broom by means of a clasp having its jaws hinged at the extremities, and fastened together at the socket, or some equivalent device, substantially as herein set forth.

"2d, A spring or springs, whether placed as herein described, inside of the brush or material composing the broom, or otherwise, so as to operate in substantially the same manner.

"3d, The cross, fastened to the spring with spurs, or otherwise, in combination with the hoop, to hold the brush or other material in its proper place, as described."

Re-issues for July, 1852.

. For an *Improvement in Bedsteads;* Nathaniel Colver, Abington, Massachusetts; patented April 24, 1849; re-issued July 6, 1852.

Claim.—"I lay no claim to a combination of rest bars or boards, spiral or wound wire springs, a sacking and closing frame, used to support a cushion or mattress; such a combination having been employed in the manufacture of sofas and other articles of furniture: but what I claim as my invention is, the method in which I construct the foundation of the bed or mattress, by means of the above described pliances or their equivalents, to wit: the lacing and the clamps and keys, or wedges, so as to render the bedstead portable, by being taken apart, or enfolded, the one part over the other, or united together, or unfolded, as above described, as occasion may require, that is to say, I claim the combination of the two frames, or halves of a box, each of said frames or halves consisting of a side, two ends, and bottom, or slats, supporting wire springs, and a sacking affixed to its side and two ends, and supported on springs or stuffing, as occasion may require, and these halves or parts so united that when together, or unfolded, they form but one box or frame, supporting or holding fast the sacking at its entire extremity, without any separating or supporting partition in the centre, and this union or junction of the two posts is effected by the above described lacing, or its equivalent, and clamps and keys or wedges, or their equivalent.

"I lay no claim to any one of the elements of the aforesaid or above described combinations, when separate from the rest; but intending only to claim the whole, as combinations, constituting a bedstead, or foundation for a bed or mattress, to which the parts as above described, or their equivalents, may be applied as aforesaid."

. For an *Improvement in Machines for Tonguing Boards;* Ransom Crosby, Jr., Assignee of Ransom Crosby, Assignee of Henry D. Edgcomb, City of New York; patented April 13, 1852; re-issued July 13, 1852.

Claim.—"I am aware that Harvey Law has described in his patent of 10th April, 1849, a mode of tonguing, in which two sets of saws are arranged in a frame, with the cutting teeth opposite, and cutting in one plane on opposite faces of the board; none of which devices we desire to claim. But what I do claim as the invention of Crosby and Edgcomb is, the employment of two independent sets of independent cutters, arranged in parallel planes in parallel stocks, with an open space between them, so as to cut on the edge of the board, all in the manner substantially as described, whereby I have the advantage combined of freedom from clogging, and the facilities of adjusting the stocks and cutters for sharpening, setting, and inspection."

Designs for July, 1852.

. For a *Design for a Parlor Stove;* Jeremiah D. Green, Assignor to Alexander Morrison and Thomas M. Tibbitts, Troy, New York, July 6.

Claim.—"What I claim as new is, the ornamental design and configuration of a parlor stove, the same as herein described and represented in the annexed drawing."

. For a *Design for a Cooking Stove;* Wm. F. Pratt and Geo. W. Bosworth, Milford, New Hampshire, July 13.

Claim.—"What we claim as our invention or production is, the ornamental design for cooking stove, substantially as represented in the accompanying drawings.

"And we also particularly claim the combination of the star, shield, and radial lance heads, as exhibited in the panel of the larger door of the side plate."

. For a *Design for a Cooking Stove;* Saml. D. Vose, Albany, New York, July 13.

Claim.—"I do not claim any detailed part of the mouldings or configuration. What I claim as my invention is, the combination of the several mouldings and ornaments, as arranged together, the whole forming an ornamental design for an air tight cook stove, as herein set forth and described."

. For a *Design for a Hat and Umbrella Stand;* Charles Zeuner, Assignor to M. Greenwood & Co., Cincinnati, Ohio, July 13.

Claim.—"What I claim as my invention is, the new design for a hat and umbrella

stand, consisting of the ornamental figures above set forth and represented in the accompanying drawings."

5. For a *Design for a Portable Grate;* Apollos Richmond, Assignor to A. C. Barstow & Co., Providence, Rhode Island, July 13.

Claim.—"What I claim as my production is, the new design, consisting of the gothic arches, mouldings, pendants, &c., herein above described and represented in the drawings for a portable grate."

6. For a *Design for Parlor Stove Plates;* Amos Paul, South Newmarket, New Hampshire, July 20.

Claim.—"What I claim as my production is, the new design, consisting of the mouldings, raised points, vine and leaf work, herein above described and represented in the drawings, for the top, bottom, and side plates of a parlor stove."

7. For a *Design for the Front and Side Plates of a Cooking Stove;* Dutee Arnold, Providence, Rhode Island, July 27.

Claim.—"What I claim as my production is, the new design, consisting of the mouldings, spear heads, and stars, with rosettes, herein above described and represented in the drawings, for the front and side plates of a cooking stove."

8. For a *Design for a Medallion of Daniel Webster;* Peter Stephenson, Boston, Massachusetts, July 27.

Claim.—"What I claim is, the design of a medallion of Daniel Webster, as represented in the drawings above referred to."

ADDITIONAL IMPROVEMENTS, FOR JULY, 1852.

1. For an *Improved Process for Mashing Maize;* Frederick Seitz, Easton, Pennsylvania; patented June 20, 1852; additional improvement dated July 13, 1852.

Claim.—"Now what I claim as my additional invention, and desire to add to my former patent, granted January 20th, 1852, is, forcing cold air into the distillery mash, through the hollow shaft arms and rakes, agitators, as above described, or by forcing it by a pipe or pipes into the bottom, or near it, of any common mashing machine or tub."

2. For an *Improvement in Metallic Heddles;* Jacob Senneff, Philadelphia, Pennsylvania; patented January 13, 1852; additional improvement dated July 20, 1852.

Claim.—"Having thus described my improvement, what I claim as my invention, and desire to have added to my patent, is, casting eyes of harness or heddles upon single or multiplied strands of worsted, silk, cotton, thread, or other material, in the manner and for the purpose herein set forth."

AUGUST.

1. For an *Improvement in Railroad Car Seats;* Charles P. Bailey, Zanesville, Ohio, August 3.

"The nature of my invention consists in combining with a permanent seat, a divided back, so arranged as that each part shall swing around the end of its respective part of the seat, when it becomes necessary to reverse the backs, and so that both parts of the back may be reversed, or only one part, leaving the occupants to sit tete-a-tete."

Claim.—"Having thus fully described my invention, what I claim therein as new is, in combination with a permanent seat or seats, a divided back, which is so constructed that one part thereof shall swing around one end of the seat, and the other part around the other end thereof, the back retaining always its upright position, and by which arrangement the two parts of the back may be entirely reversed, or they may be left tete-a-tete, substantially as herein described."

2. For an *Improvement in Looms for Weaving Figured Fabrics;* Cornelius W. Blanchard, Clinton, Massachusetts, August 3.

Claim.—"I do not claim the application of the above named levers to the trap or knot boards of the jacquard loom; but what I do claim therein as new is, 1st, The opening or raising and depressing the harness, by means of levers or bars, oscillating about a fixed point or points, in connexion with hooks or their equivalents, which catch upon these levers or bars, and which constitute a part of the connexions between the top and bottom

s, cords, or other devices, for raising and drawing down the harness, thus raising ing the heddles, in a greater or less degree, according as they are more or less om the fell, or cloth making point, the motions of the harness all commencing ig at the same time, as herein substantially described.

claim the method as described, of arranging and combining the parts for moving ng chain or cylinder with the other parts of the machine, so as to carry the said cylinder back as well as forward, as the machine is made to move backward and

Improvement in Pressure Gauges; Eugene Bourdon, Paris, France, August 3; ated in France, June 18, 1849.

—"Having now described my invention, I wish it to be understood that I claim ation of curved or twisted tubes, whose transverse section differs from a circular the construction of instruments for measuring, indicating, and regulating the and temperature of fluids, substantially as above described."

Improvement in Dumping Wagons; Thomas Castor, Frankford, Pennsylva- August 3.

ivention consists in balancing the body of a wagon, at or about its centre, on a t projects upward from the frame of the running gear, and serves as a fulcrum ig point for the body to turn and run on, to facilitate the dumping of its load, and ement in the loading position."

—"Having thus described my improved dumping wagon, what I claim therein the arrangement of the body on a fixed roller fulcrum on the frame of the run- , in such manner that by a slight amount of force the body can be turned, to nder side, which rests on the roller, either a forward or backward inclination, to weight of its load to tend to hold it forward or back, as it is required to carry or the same, substantially as herein set forth."

Improved Tally Board; Francis N. Clark, Chicago, Illinois, August 3.

ature of my invention consists in having a series of screw rods properly secured ard, said screw rods having nuts upon them, which are moved either to the right cording as the rods are turned upon the board, and underneath each nut there is which is graduated in any proper manner; by turning either screw rod, the nut d is moved, and the graduated space shows how far the nut has moved and the allied."

—"I do not confine myself to any particular form or manner of arranging the ls over the board, nor to any particular manner of graduating the spaces; but aim as new is, the manner of tallying or keeping an account of articles, as they red or moved, by means of screw rods, having nuts upon them, said nuts being ver graduated spaces, which indicate the distance the nuts have moved, or give er of turns or half turns of the rods; the rods, nuts, and spaces being arranged as d described, or in any other manner substantially the same."

Improvement in Casting Stereotype Plates; Hobart P. Cook, Albany, New k, August 3.

ature of my invention consists in using, by means of appropriate mechanical ent, the power of compressed air or of steam, in the casting of stereotype plates; nsuring greater rapidity in the process of casting, with a decreased liability of the plates while being cast, and at a much reduced cost of production."

—"What I claim as my invention is, the manner of casting stereotype plates, plication of pressure upon the surface of the melted metal in the inner kettle, essure forces the metal, while fluid, through a tube and upon the mould, the face uld being turned down to receive the metal making the casting; the whole acting ally in the manner and upon the principles set forth and described in the specifi-

Improvement in Compositions for Preserving Butter; Louis De Corn, Cin- ati, Ohio, August 3.

y process, any quantity of butter can be preserved, indefinitely, fresh; I mean, eserved always fresh for any length of time."

—"What I claim as my invention is, the preservation of fresh butter, for any time, as herein described, using for that purpose the aforesaid chemical compound, ivalent, substantially in the manner and for the purpose set forth."

8. For an *Improvement in Looms for Weaving Figured Fabrics;* Samuel and James Eccles, Kensington, Pennsylvania, August 3.

Claim.—"What we claim as constituting our invention is, 1st, The star movers, whether they be arranged to slide, instead of the star wheel, or otherwise, and neutral surface, in combination with the star wheel, (sliding or otherwise,) arranged substantially in the manner and for the purpose herein specified.

"2d, We claim the pins, or pattern plates, or their equivalents, in combination with the diamond shaped projection, or four sided inclined plane, lever, and star wheel, arranged substantially as described, for the purposes herein specified.

"3d, We claim the guide, in combination with the star movers and star wheel, as described.

"4th, We claim the combination formed by the mechanism herein described, for giving a positive and correct motion to the jacquard card cylinder, that is to say, the star mover, star wheel, and connecting arms, with mitre wheels, or their equivalents, as herein fully made known, and the above mechanism is also intended to be applied to other description of looms where lags and other similar devices are used, instead of the cards, as on barrel and other similar looms; therefore, the claim is not limited to the turning of a jacquard card cylinder."

9. For an *Improvement in Adjusting the Chasers in Screw Cutting Stocks;* Mitchell C. Gardner, Brockport, New York, August 3.

"The nature of my invention consists in arranging an adjustable band, on which the index is lettered, for adjusting the index to the chasers, the same being adjustable to the wear of the chasers, or to chasers of different lengths, and in combination with suitable apparatus for causing said chasers to approach or recede from a common centre."

Claim.—"Having thus fully described my invention, I do not claim the index, but what I do claim is, the adjustable band, *d*, fig. 4, and *d*, *d*, fig. 5, on which the index is lettered, for adjusting the index to the chasers; the same being adjustable to the wear of the chasers, or to chasers of different lengths; and in combination with suitable apparatus for causing said chasers to approach and recede from a common centre, for the purposes stated.

"And I also claim the shaft, *f*, as shown in figs. 2 and 4; and pinion, H, fig. 2, in combination with pinions, G, G, G, G, fig. 2, and the bevel gear wheel, E, fig. 3, at the outer end of which shaft is attached a crank, to drive the bevel gear wheel, E, fig. 3, as herein before set forth and described, and for the purposes stated."

10. For an *Improvement in Scales for Weighing;* William P. Goolman and William Holtsechaw, Jr., Springtown, Indiana, August 3.

"The nature of our invention consists in making the weighing beam with two long graduated arms, instead of one only, and applying a pea, or weight, to each of them; the divisions on one arm indicating pounds, or tens, or hundreds, &c., of pounds, according to the size of the balance, and those on the other arm, the ounces, quarter pounds, or pounds, or any sub-divisions or fractions of the larger weights that may be desired."

Claim.—"What we claim as our invention is, the making of the weighing beam of platform or other balances, or scales, with two graduated arms, extending in opposite directions from the fulcrum of said beam, and applying one or more movable weights, or peas, to each of them; the divisions on one arm indicating the larger divisions of weight, and those on the other, any sub-divisions or fractions of the larger that may be desired, substantially as herein set forth and described."

11. For an *Improvement in Jacquard Looms;* John Goulding, Worcester, Massachusetts, August 3.

Claim.—"What I claim as my invention is, 1st, connecting the knot and trap boards with, and operating them by levers, arranged substantially as herein described, so that the second row of heddles or harness, shall fall and rise so much farther than the first, and the third than the second, and so on through the entire series of heddles, or harness, that, as the warp is sprung, the threads in the same shed, from each row of heddles, whether front, middle, or back, and whether sprung in the top or bottom shed, all lies substantially in the same plane.

"2d, The apparatus which inserts and draws the wires to form the pile, constructed and operated substantially as described.

"3d, The devices for locking and unlocking the beam or beams containing the warp, substantially as described."

12. For an *Improvement in Ox Yokes;* Ezra Hough, St. Johnsville, New York, August 3.

"By the use of my improved slide yoke, oxen will work much easier, and will not crowd, or haul, as is often the case, in using the ordinary yoke; each ox endeavoring to obtain some advantage over his mate."

Claim.—"I do not claim the slides, independently of their connexion, as they have been previously used; but, having described the nature of my invention, what I claim as new is, the connecting of the slides, in which the bows are secured, by means of the chains and rods; the chains passing over the pulleys, by which neither of the slides or bows can be moved laterally, without communicating a corresponding opposite motion to the other; thus keeping the oxen, at all times, at equal distances from the centre of the yoke, the chains, rods, and pulley, being arranged as shown and described, or in any other manner substantially the same."

13. For an *Improved Elastic Horse Shoe;* John O. Jones, Newton, Massachusetts, August 3.

Claim.—What I claim is, the shoe, formed with two plates, between which a sheet of vulcanized rubber or other elastic substance is interposed, in the manner and for the purpose herein set forth."

14. For an *Improvement in Scythe Fastenings;* Alpheus Kimball, Fitchburgh, Massachusetts, August 3.

Claim.—"Now, I would remark that I do not claim the invention of confining the shank to the snath, by fastening contrivances applied both to the heel and toe of the scythe, particularly when the fastening contrivance of the toe is made to press against the toe, in a direction towards the heel of the scythe, as, under such circumstances, the variation of the angle of the blade and snath is generally limited to certain fixed positions; but what I do claim as my improvement is, to make the fastening bolt of the toe act against the side of the toe, or laterally against the shank, in combination with making it, or the bolt and shank, with the peculiar curved projection, and recess, and the flattened faced stirrup, or confining contrivance of the heel of the shank, so as to allow of the lateral position of the heel being changed, or varied, as specified, whereby the angle of the shank part of the snath and of the blade may not only be varied to any extent within certain limits, but the toe of the shank, as usually made, confined down by other means than that which operates to secure the shank (at its heel) to the snath."

MECHANICS, PHYSICS, AND CHEMISTRY.

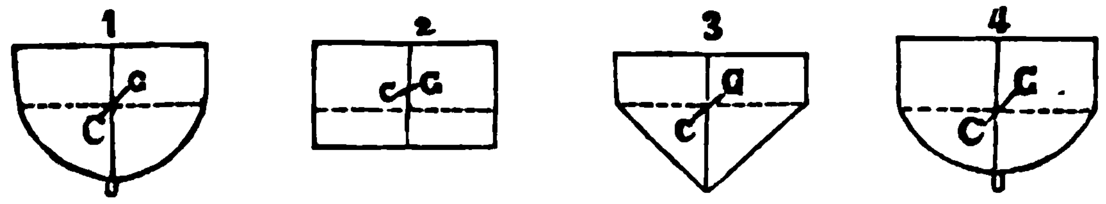
Hints on the Principles which should regulate the Forms of Boats and Ships; derived from original Experiments. By MR. WILLIAM BLAND, *of Sittingbourne, Kent.**

Continued from page 132.

CHAPTER XI.—OF THE LEE WAY, OR LATERAL RESISTANCE.

This property in a ship depends (see experiment 5,) directly upon the perpendicular depth at which it floats, and the length. The following is a course of experiments relative to the lateral resistance of different midship sections or forms, and having reference to the depths of keels.

The midship forms selected for the experiments were those which had been employed in Chapter X., Experiments 41, &c. The diagrams are again given, but with the addition of keels to two of them. The results were measured by the length of lever, not by weights.



c, the centre of gravity, and the dotted lines the depth of flotation.

* From the London Architect for September, 1851.

Experiment 44.

No. 1. Semicircular bottom,	Weight.	Each with $\frac{1}{2}$-inch
No. 4. Elliptic bottom,	1 lb. 13 oz.	depth of keel.

Result.—No. 1 resisted most, and equal to 1 inch of lever.

Experiment 45.

No. 1: Semicircular bottom,	Weight,	Each with $\frac{1}{2}$-inch
No. 2. Flat bottom,	1 lb. 13 oz.	depth of keel.

Result.—No. 2 resisted most, and equal to $1\frac{1}{2}$ inch of lever.

Experiment 46.

No. 1. Semicircular bottom,	Weight,	Each with $\frac{1}{2}$-inch
No. 3. V or Triangular bottom,	1 lb. 13 oz.	depth of keel.

Result.—No. 3 resisted most, and equal to 1 inch of lever, but was disposed to turn over.

Experiment 47.

No. 1. Semicircular bottom,	Weight,	With $\frac{1}{2}$-inch keel.
No. 4. Elliptic bottom,	1 lb. 13 oz.	With 1 inch keel.

Result.—No. 1 resisted most, and equal to 1 inch of lever.

Experiment 48.

No. 1. Semicircular bottom,	Weight,	With $\frac{1}{2}$-inch keel.
No. 2. Flat bottom,	1 lb. 13 oz.	With 1 inch keel.

Result.—No. 2 resisted most, and equal to $1\frac{1}{2}$ inch of lever.

Experiment 49.

No. 1. Semicircular bottom,	Weight,	With $\frac{1}{2}$-inch keel.
No. 3. V or Triangular bottom,	1 lb. 13 oz.	With 1 inch keel.

Result.—No. 3 was overturned by the resistance.

Experiment 50.

No. 1. Semicircular bottom,	Weight,	Each with $\frac{1}{4}$-inch
No. 2. Flat bottom,	1 lb. 13 oz.	depth of keel.

Result.—No. 2 resisted most, and equal to 3 inches of lever.

Experiment 51.

No. 1. Semicircular bottom,	Weight,	Each with $\frac{1}{4}$-inch
No. 4. Elliptic bottom,	1 lb. 13 oz.	depth of keel.

Result.—No. 1 resisted most, and equal to 1 inch of lever.

Experiment 52.

No. 1. Semicircular bottom,	Weight,	Each with $\frac{1}{4}$-inch
No. 3. V or Triangular bottom,	1 lb. 13 oz.	depth of keel.

Result.—No. 3 resisted, but overturned.

Experiment 53.

No. 1. Semicircular bottom,	Weight,	With $\frac{1}{2}$-inch keel.
No. 2. Flat bottom,	1 lb. 13 oz.	With $\frac{1}{4}$-inch keel.

Result.—No. 2 resisted most, and equal to $1\frac{1}{2}$ inch of lever.

Experiment 54.

No. 2. Flat bottom,	Weight,	No keel.
No. 3. V or Triangular bottom,	1 lb. 13 oz.	No keel.

Result.—The resistance equal.

Experiment 55.

No. 1. Semicircular bottom,	Weight,	No keel.
No. 3. V or Triangular bottom,	1 lb. 13 oz.	No keel.

Result.—No. 3 resisted most, and equal to 4 inches of lever.

Experiment 56.

No. 3. V or Triangular bottom,	Weight,	No keel.
No. 4. Elliptic bottom,	1 lb. 13 oz.	No keel.

Result.—No. 3 resisted most, and equal to 6 inches of lever.

Experiment 57.

No. 1. Semicircular bottom,	Weight,	With $\frac{1}{2}$-inch keel.
No. 2. Flat bottom,	1 lb. 13 oz.	No keel.

Result.—No. 2 resisted most, and equal to 1$\frac{1}{2}$ inch of lever.

Experiment 58.

No. 1. Semicircular bottom,	Weight,	With 1 inch keel.
No. 4. Elliptic bottom,	1 lb. 13 oz.	With $\frac{1}{2}$-inch keel.

Result.—The resistance was equal, but No. 1 overturned.

Observations on the Results of the Lateral Resistance of the Four Models.

No. 1 resisted most with a depth of keel of $\frac{1}{2}$-inch.

No. 2 resisted most with a depth of keel of $\frac{1}{4}$-inch, $\frac{1}{2}$-inch, 1 inch, and no keel.

No. 3 resisted most with no keel.

No. 4 was beat in every instance when tested against either of the others with equal depth of keel; but was equal to No. 1 when that had 1 inch keel and No. 4 had $\frac{1}{2}$-inch keel.

Again, No. 1 possessed the least resistance with 1 inch of keel.

No. 2. The variations in the depth of keel made no difference.

No. 3 had the least resistance with 1 inch of keel.

No. 4 had the least resistance with no keel.

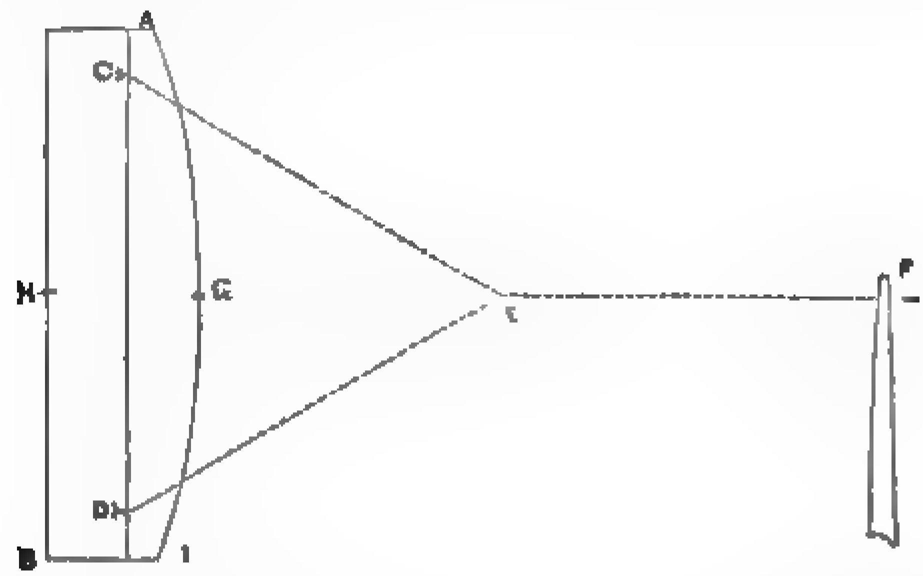
The scale of superiority appears to be thus—

No. 2, the flat bottomed, most decidedly the best, or	1.
No. 1, the semicircular bottomed,	2.
No. 4, the elliptic-bottomed,	3.
No. 3, the triangular bottomed the most dangerous, except with no keel,	4.

On turning to the diagrams it will be seen that the centres of gravity of Nos. 2 and 4 are lower than those of Nos. 1 and 3. Again, the lines of flotation of Nos. 2 and 4 are likewise lower than Nos. 1 and 3. This being the case, the lateral leverage of Nos. 2 and 4 above the water is greater than that of the other two; and their leverage is, on the contrary, greatest in the water, particularly the triangular bottom. No. 2 floats higher than it would have done, had it not been made hollow in part to reduce its weight down to the others.

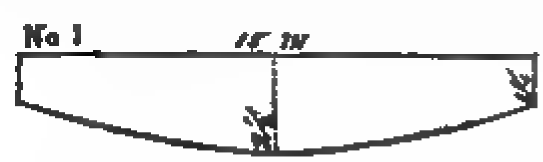
The mode by which the lateral resistance was tested will be clearest understood by the inspection of the accompanying diagram. A B represents the upper surface of the models, being 14 inches long and 4 inches wide at G H; C, and D, the two rails to which the lines, C E,

and D E, were attached; E F, is the single line fixed on the end of the balance rod, F. The sides of the models were rounded off as A G I, to prevent oscillation whilst being drawn through the water; at the same time, partaking more of the usual form of the sides of a ship.

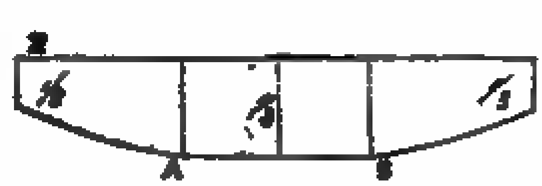


Whilst carrying out these experiments on lateral resistance and keels, many instances occurred of the superior effects in the lengthening of a keel, over the deepening of one. The deepening of a keel acts directly and powerfully to overturn—not so the lengthening; and although a small addition in depth may and does, under certain circumstances, improve a ship's lateral resistance, yet, if the depth be much increased, it so militates against the object sought by the great inclination which ensues, consequent on the force of lateral resistance, as to be altogether injurious.

The next experiments were taken to ascertain the effects, as regards speed, of curving up the bottoms of vessels from the midship or mid length, to both head and stern as high as the load water line; or commencing the same at one-third or one-fourth of the length of each, and leaving the middle one-third or one-fourth of each quite straight or uncurved.



Experiment 59.—A model, 14 inches long, 4 inches wide, and 2¼ inches in thickness, weight, 30 oz.; curved from middle length to head and stern, as No. 1.



Experiment 60.—The model, No. 2, of the precise length, breadth, depth, and weight, as No. 1, but having the bottom, A B, one-third of the length, quite level or straight.

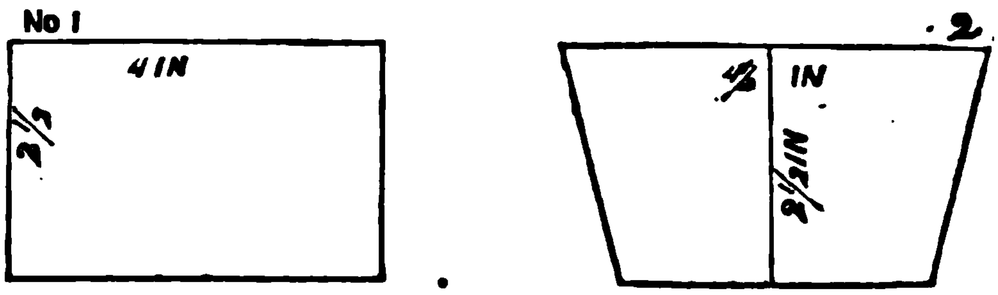
Experiment 61.—The model, No. 3, of the same dimensions, &c., as the preceding, but with the bottom, A B, left flat half of the length.

Result.—No. 1 beat in speed No. 2, by 1¼ oz. extra weight; No. 2 beat in speed No. 3 by 2 oz. extra weight; therefore, No. 1 beat in speed No. 3, by 3¼ oz. extra weight.

Experiment 62.—This experiment was undertaken to ascertain what might be the advantage, as regards stability, by constructing a ship with projecting sides, instead of carrying them up perpendicularly.

Two models were made, each 15 inches long, 2½ inches deep, with flat bottoms; but one of them 4 inches wide, and perpendicular sides, the other being in width at the bottom at midships 3½ inches, and across the top 4½ inches, and making an angle from the perpendicular of 11°.

Sections of the Models taken at the midships.



Scale, ½-inch to 1 inch; weight of each, 40 oz.

These models were first tested upon the water, each in solid wood, when the stability of each equalled 3 oz. But when a part of the upper insides of both the models was hollowed out, which reduced their respective weights to 33 oz., the stability of No. 1 equalled 3½ oz., and that of No. 2, 3 oz. only.

Let it be observed, that before either of the models were lightened, No. 1 sank in the water 1¼ inch, and No. 2, 1⅜ inch. After being lightened, No. 1 sank in the water 1⅛ inch, and No. 2, 1¼ inch.

The result of lightening the weight of each model from the upper part was the lowering of their centres of gravity, which at once became apparent in No. 1, by its increased stability. But the same result did not follow in No. 2, because of the diminished width of the lower line of its flotation. This proves, most clearly, that the mere lowering of the centre of gravity acts with far less effect, with respect to the increase of stability, than the widening of the beam, or preserving the same as in No. 1.

Of the Rudder.

The rudder is a flat frame-work of timber, ascending perpendicularly from the bottom of the keel, to a distance above the surface of the water, sufficient to admit of a lever being fastened to it in nearly a horizontal position, to move the same either to the right or left; it being so attached to the stern post by means of hooks and rides, or similar contrivances, as to admit of such lateral motion.

The purpose of the rudder is to alter the direct course of a vessel, when its body is going through the water, and into any position the helmsman may desire. That the rudder may act with full effect, it is necessary for the water to have as direct and unimpeded a course against either of its sides, as it is possible to allow. The wider the body of the rudder is made, the greater the power; but in general, it does not much exceed in sailing vessels one twenty-eighth part of a ship's length.

Of the Keel.

The keel is that part of a boat or ship, which is situated at the bottom on the outside, and extends in a direct line from the cut-water at the head, to the post at the stern, descending perpendicularly down below the hull to the depth of several inches or feet according to the size of the vessel. Its uses are, first, to cause the floating body, say of a ship, to preserve a direct course in its passage through the water; second, to act as a check to lee-way; third, to moderate the rolling motion.

Ships formed with flat bottoms, and particularly if they be constructed with parallel sides, require little depth of keel to preserve a direct course; and in order to check the lee-way, a substitute for a keel is applied in the form of a sliding keel, suspended over the lee side, as seen in barges. But when the bottoms of vessels are not flat, or do not draw the same depth of water at the head and stern, particularly the latter, the keel becomes more essential, or the ship will have a rotary motion and be under no command.

With regard to the depths of keels, it will be needless to repeat what has already been given in the experiments, from 48 to 58, Chapter XI.

(To be Continued.)

Translated for the Journal of the Franklin Institute.

New Method of Magnetizing Steel. Letter of Mr. Hamann.

While studying the construction of electro-magnetic apparatus, I looked for the means of making very energetic magnets. I have discovered a new method of magnetizing steel dry-tempered, which is in some degree the opposite of the ordinary method. I magnetize first and temper afterwards. I cause a magnet or an electric current to act on the steel heated to redness, and I temper it while in this condition. The experiment is very simple; by taking a small bar of steel of 3 millimetres square by 6 centimetres long, (0·1 in. by 2¼ inches,) heated to redness with the pole or between the poles of a magnet, to which at a certain temperature it will remain attached, and plunging the whole into water. In this way will be obtained a small magnet of considerable energy. English refined cast steel, which tempers at a relatively low heat, appeared to me the most suitable for these experiments. I operated with advantage, as compared with other modes of magnetizing, upon bars 12 millimetres (0·4 in.) broad, 6 mm. (0·2 in.) thick, and 17 centimetres (6·7 in.) long. I propose to follow up my experiments, and I believe that the simple fact of the magnetizing of steel before tempering it, is of a nature to interest those who occupy themselves in this branch of physical science.—*Comptes Rendus de l'Academie des Sciences, (Paris,) 29th March,* 1852.

Note.—In *Silliman's Journal* for 1839, Vol. xxxvi. p. 335, will be found an interesting account by J. Lawrence Smith, of his experiments with the above process of magnetizing steel bars, in which he carried it further into successful practice than Mr. Hamann seems to have done. Something resembling it must be also the method of Mr. Faber, by which the magnets of his steam gauge are enabled to resist temperatures, at which the force of bars treated in the usual way, is altogether lost. It would be very desirable to have a detailed description of Mr. F.'s processes and experiments.

For the Journal of the Franklin Institute.

On the Telegraphic Lines of the World. *By* Dr. L. Turnbull.

Continued from page 138.

United States.

Before concluding my list of the lines in the United States, I received the following interesting account of the telegraph in Ohio, showing the rapid progress which it is making in the West, for which account I am indebted to the politeness of J. H. Wade, Esq., of the "Wade Telegraph Office," Columbus, Ohio.

	Miles.
Cleveland and Cincinnati Telegraph Company, with two lines on separate routes, with an arm from Newark to Zanesville, and another from Mansfield to Sandusky; length of line, . , ...	640
Cincinnati and Sandusky Telegraph Company, line from Cincinnati to Sandusky,	218
Scioto Valley Telegraph Company, line from Columbus to Portsmouth,	90
Columbus and Lancaster Telegraph Company, line from Columbus to Lancaster, 25 miles, and an arm to Logansport, 15 miles, . . .	40
Pittsburg, Cincinnati, and Louisville Telegraph Company, from Pittsburg to Louisville, two wires on same poles, 280 each, (in Ohio,) .	560
Cincinnati and St. Louis Telegraph Company, from Cincinnati to St. Louis,	50
House Printing Telegraph line, from Buffalo to Cincinnati, . .	325
Erie and Michigan Telegraph Company, from Buffalo to Milwaukie, with two wires as far as Cleveland; length of wire in Ohio, . . .	260
Lake Erie Telegraph Company, from Buffalo to Detroit, with branch to Pittsburg; length of wire in Ohio, ...	286
Cleveland, Wheeling, and Zanesville Telegraph Company, . .	225
Cleveland and Pittsburg Telegraph Company; length of wire in Ohio, .	90
New Orleans and Ohio Telegraph Company, from Pittsburg to New Orleans; length of wire in Ohio, ...	260
Ohio, Indiana, and Illinois Telegraph Company, from Cincinnati to Dayton and Chicago; length in Ohio, about	100
Line from Zanesville to Marietta, ...	66
Total length of wire in Ohio, .	3210

Canada.

From O. S. Wood, Esq., Montreal Telegraph Company, I have received the list of the lines in Canada.

	Miles.
The Montreal Telegraph Company's Line extends from Quebec to the Suspension Bridge at Niagara Falls; distance, ... ·	155
British North American Electric Telegraph Association, from Quebec to New Brunswick frontier; distance, ...	220
The Montreal and Troy Telegraph Company, from Montreal to New York State line at Highgate; distance, ...	47
The Bytown and Montreal Telegraph Company, from Bytown to Montreal; distance, ...	115
The Western Telegraph Company, from Hamilton to Port Sarnia, at the foot of Lake Huron; not now working; distance, ...	143
Niagara and Chippewa Line, from Niagara to Chippewa; distance, .	14
All the above lines have single wires.	
In course of construction, a line from Brantford to Simcoe and Dover; distance,	33
Also, a line from Kingston to Hamilton, via. Prince Edwards Co.; distance,	256
Total length in Canada, ...	983

England.

The English telegraphs come next in extent to those of the U. States: they were first established in 1845, and may be divided into two classes—the railway and the commercial. The railway telegraphs are used for the purpose of sending communications relative to railway matters, while the commercial are employed for the transmission of public and private messages at fixed rates of charges. They are mostly built on the railroads, and in some instances a railroad company will construct a line, and give the use of it to a company, and as an equivalent, the telegraph lends its aid to expedite the business of the railroad. The telegraph company between London and Liverpool receives one thousand pounds a year for doing the business of the railroad company, and the railroad people afford them all the facilities for repairing the line, even so far as sending an extra engine, without charge, when there is not a regular train going out soon; and every man employed on the railroad is under instructions to report immediately to the nearest telegraph office, anything he may find to be out of order on the line. In fact, a line of telegraph is almost considered an indispensable part of the equipage of all well regulated roads in England. The instruments principally in use are those of Messrs. Cook and Wheatsone, Jacob Brett, and Brett and Little. There is a line of Bain's Electro-Chemical Telegraph from London to Manchester, and from Manchester to Liverpool. Also, a line of Bain's Electric Telegraph, connecting Edinburgh and Glasgow, a distance of 46 miles: the whole extent of telegraphic lines is estimated at 2225 miles. The principal ones are as follows:

England, Scotland, and Ireland.

I extract from the Manual of Mr. Walker, telegraphic engineer, a list of the linesof the Electric Telegraphs of England, for 1852.

	Miles.	Wires.	Apparatus.
Edinburgh and Glasgow,	47½	5	8
Line of the Tunnel,	1	2	2
Edinburgh and the North Branch to Dundee,	26	3	6
" " " Perth,	6	3	0
Edinburgh and Granton,	3	3	3
Line to Leith,	1½	3	3
Line of Tunnel,	1	2	2
North British,	58	5	8
Branch to Dalkeith,	1¼	2	2
" Haddington,	5	2	2
Line of the Tunnel,	1¾	2	2
York, New Castle, and Berwick.			
New Castle to Berwick,	65½	5	7
York to Darlington,	45	7	15
Darlington to New Castle,	38½	8	14
Branch to Shields,	11	3	2
" Sunderland,	2¼	3	2
" Durham,	2¼	2	1
" Richmond,	9	2	1
Fatfield and South Shields,	19	1	4
Branch to Stockton,	½	1	2
Carried up,	345	64	86

	Miles.	Wires.	Apparatus.
Brought up,	345	64	66
York and North Midland.			
Normanton to York,	24¼	0	5
York to Scarborough,	42½	3	5
Branch to Harrowgate,	18	3	2
Hull and Selby,	36	6	5
Hull and Bridlington,	33	3	4
Normanton to the junction at Milford,	10	2	2
Manchester and Leeds,	61	7	24
Preston and Wyre,	20	3	4
Liverpool and Southport,	13¼	3	3
East Lancashire,	19½	3	0
Midland Railway.			
Birmingham and Gloucester,	53	7	9
" " Derby,	6¼	7	6
" " Derby,	34¾	5	0
Derby and Lincoln,	48¾	3	4
" Rugby,	24¼	7	7
" Rugby,	24¾	5	0
Leicester and Peterborough,	4¾	9	0
" Peterborough,	23	5	11
" Peterborough,	25¼	7	0
Derby and Leeds,	73	7	25
Branch to Sheffield,	5	3	2
Leeds and Bradford,	11	6	5
" Bradford,	2¾	3	0
" Bradford line of Tunnel,	1½	2	2
Branch to Skipton,	15¼	3	5
London and North Western.			
London to Birmingham,	5	9	0
" Birmingham,	107½	7	10
" Birmingham line of Tunnel,	1	3	2
" Birmingham Inclined Plane,	1¼	6	6
East Junction to London,	½	2	4
Birmingham and Manchester,	60	7	7
Do. do. do.	5	8	0
Junction to Ardwick,	3¼	8	0
Manchester and Liverpool,	31½	6	5
Do. do. line of Tunnel,	1½	2	3
South Devon.			
Branch to Torquay,	4	3	2
Newmarket Railway.	17	5	4
Eastern Union,	16¾	5	7
Line of the Tunnel,	2¾	2	3
London to Southampton,	74	4	4
Do. do.	6	6	2
Branch to Portsmouth,	21	4	4
" Gosport,	5	4	1
Southampton and Dorchester,	61	3	7
Branch to Poole,	2	3	2
Eastern Counties.			
London to Brandon,	88¼	7	40
" Stratford,	33¾	2	4
Line to Brick Lane,	½	2	3
Branch to Enfield,	3¼	2	2
" Hertford,	7	3	3
Cambridge and St. Ives,	14¾	3	6
Ely and Peterborough,	30	6	7
March and Wisbeach,	9	8	2
London and Colchester,	51¼	6	19
Carried over,	1641¼	[illegible]	[illegible]

	Miles.	Wires.	Apparatus.
Brought over,	1641¼	298	368
Forestgate and Stratford,	1¼	1	2
Maldon and Braintree,	12	3	3
Stratford and Junction of the Thames,	2¾	3	2
North Woolwich,	2¾	3	2
Norfolk Railway.			
Brandon to Norwich,	37¾	7	19
Do. do.	10¼	1	7
Norwich and Yarmouth,	20	9	0
Branch to Lowestoft,	12	5	0
" Dereham,	12	3	2
Dereham and Fakenham,	12¼	2	2
North Staffordshire.			
Stoke to Norton Bridge,	10¾	3	3
Branch to Colwich,	18¾	2	2
Stoke to Burton,	29½	3	5
" " depot,	⅔	2	2
North Staffordshire.			
Stoke to Crewe,	14½	3	4
Harecastle Line of the Tunnel,	1	2	2
Branch to Macclesfield,	19½	3	4
Valley of Churnet,	27	2	0
South Staffordshire,	9¼	2	3
Do. do,	2	3	1
Northampton and Peterborough,	47	3	10
Northampton prolongated to Wolverton,	10½	4	2
London and Croydon,	8	3	4
Great Western,	19	4	2
Line of the Streets of London,	variable,		10
Manchester and Sheffield,	2	3	3
Manchester Line of the Tunnel of Woodhead,	3¼	3	2
Ambergate, Matlock, and Buxton,	11½	2	3
London and Blackwall,	3½	0	0
Line of Caldon Low Quarry,	3¼	1	4
Mines of the coal of Moira,	½	2	2
Maryport and Whitehaven	½	4	4
Line of the Company of Iron Mines of Butterley,	2½	1	2
South Eastern.			
London to Dover,	88	0	29
" Rochester,	31	4	18
" Bricklayer's Arms,	4	2	2
Tunbridge to Tunbridge Wells,	5	3	6
" Hastings Road,	1	2	2
" Laboratory,	0	1	2
Paddock Wood to Maidstone,	10	3	5
Ashford to Ramsgate,	30	3	5
Minster to Deal,	9	3	6
Ramsgate to Margate,	4	3	2
Total,	2190⅔	420	558

Their mode of construction in England is very expensive, amounting in some cases to $600 per mile. Posts of fir are ranged at convenient distances along the side of the principal railways; each post is furnished with an insulator of earthenware, and also capped with a wooden roof having dripping eaves to throw the water from the wires. The latter are made of galvanized iron, two of which are needed on a line working with Cook and Wheatstone's instruments.

The press of England use the telegraph but little, and pay heavily for what they get by it. The *London Times* pays one thousand pounds

per annum for a certain amount daily, and in addition, they pay for all extra communications of importance. The charge for transmission of communications by the Electric Telegraph Company's telegraphs in England, is at the rate of one penny per mile for the first fifty miles, and one farthing per mile for any distance beyond one hundred miles. The South Eastern Railway Company's charges for telegraphic communications are even much higher than those of the former. Thus, twenty words transmitted eighty-eight miles is charged the large sum of $2·42. These facts show that telegraph companies, as well as the public at large, would derive much greater advantages from their construction on a more economical plan, like that of the American system. In many parts of the United States where railways do not exist, the wires are stretched across the prairies without any protection whatever, except the general good will of the people at large. The cheap construction of these lines renders them liable to frequent disorder, and consequently needing continual repair, so that perhaps it might have been more economical to have expended more in the commencement. Its advantages are, however, abundantly proved, as the poorest person in the U. States or Canada, is enabled by the low rate of charges to use any of the telegraphs for domestic purposes. A message of twenty words can be sent a distance of 500 miles in the United States for $1, while in England the same would cost from $7 to $8.

Sub-Marine Telegraph, 1852.—A London letter under date of June 4th, says: The chief event of the week has been the laying down of the submarine telegraph between the coasts of England and Ireland, a distance of 64 miles. On the 2d instant, at 4 o'clock in the morning, the operation commenced by the departure of a steamer from Holyhead, and at half past eight in the evening a gun was fired at Dublin by means of the electric wire. The process has been an inexpensive one, and will probably prove remunerative, and lead to the establishment of many other lines. Among these, one of the first will be from the port of Harwich, on the east coast of England, to Holland, a concession for that purpose having lately been granted by the Dutch Government.

A similar communication with Belgium, between Dover and Ostend, is also contemplated. These enterprises will all be carried out by separate interests. The company that first established the practicability of such a method of ocean communication, by laying down the wire between England and France, might have secured all the advantages of the extension of the principle, but their Board of Directors have been incessantly quarrelling among themselves, and have consequently brought their own shares to a discount. In June, 1852, the telegraph between Dover and Ostend was completed; it is seventy English miles long.

Telegraph Extensions, June 27.—Private letters received per Atlantic state that F. N. Gisborne, Esq., the agent of the Newfoundland Electric Telegraph Company, has contracted in England for the land wire, through Newfoundland, upon very favorable terms. Mr. Gisborne has also entered into contracts for the sub-marine line, connecting Newfoundland with Nova Scotia, upon terms much less than estimated. Messrs. Newall & Co. of London, the contractors for the submarine, have also entered into contract to lay down a line from the Hague to Harwich, a distance

of 135 miles, and are now negotiating with the French Government for a line from France to Algiers; a stretch of 400.

Ireland.

An Irish Sub-marine Line Telegraph, between Fort Patrick and Donoughadee, was to be opened on the 10th of June.

A line of telegraph has been opened between Dublin and Galway, and was in operation in June, 1852.

Prussia.

The Prussian Telegraph system is characterized as simple, substantial, effective and economical. A Royal Commission was appointed in 1844, to ascertain the best method of constructing lines; they, after experiment, determined on that of copper wire enclosed in gutta percha, and buried two feet beneath the surface; they are generally made to follow the track of railways, and in passing over bridges or aqueducts, are enclosed in iron piping, or when through rivers in chain pipes. They use but one wire, which terminates in an earth battery, consisting of a zinc plate 6 feet long, 2½ feet wide, and ⅛-th of an inch in thickness. The instruments used are those of Morse, Siemens, Halske, and Kramer, together with Daniel's battery. In the principal offices, a printing and a colloquial instrument are employed, but each in turn is worked by the one wire only, notice being given that one or the other is to be used, according to circumstances. Morse's is the printing telegraph used, and differs but very little from that used in the U. States. Those of Siemens and Kramer are both colloquial telegraphs, but Siemens' is chiefly used. The whole cost, as determined from detailed estimates, is less than $200 per English mile. Besides the government lines of telegraph, most of the railway companies in Prussia, have also their own telegraphs, which are constructed according to the system in this country by one wire suspended on poles along the railways. The average cost of this form of telegraph is about $100 per mile; their whole length is estimated at 1493 miles, having their central point at Berlin, from whence they radiate as follows:

Instruments used.	Stations and points passed through.	Distance in miles.
Siemens and Halske's Patent,	From Berlin to Frankfort on the Main, established in February, 1849, ...	350
Kramer's Bell Telegraph,	From Berlin through Cologne to Achen, established in June, 1849, ...	363
	Stations are Potsdam, Magdeburgh, Ochsertleben, Brunswick, Hanover, Minder, Haurm, Dusseldorf, Deutz, Cologne.	
Seimens and Halske's Patent,	From Dusseldorf to Elberfeld, ...	16
Morse's Apparatus,	From Berlin through Minder to Rolu, . . .	81
Siemens and Halske's,	" " to Hamburgh, ...	142
" "	" " Stettin, ...	62
" "	" " through to Oderburgh to Breslau, .	280
" "	" Halle to Leipzic, ...	17
" "	" Leipzic to Berlin, ...	115
" "	" Leipzic to Frankfort on the Main, . .	294
Siemens' Telegraph,	" Berlin to Gross Bercen	
" "	A contemplated one from Berlin to Konigsberg to Dantzic	
Morse Instrument,	From Hamburgh to Cuxhaven, ...	[illegible]

The Prussian method of burying the wires beneath the surface, protects

them from destruction by malice, and makes them less liable to injury by lightning.

Austria.

The Austrian Telegraphs diverge from Vienna, in the following manner:

1,	From Vienna through Olmutz to Prague,	237	miles.
2,	" " " Bumn "	211	"
3,	" " to Pressburgh,	35	"
4,	" " through Prevau to Oberberg,	140	"
5,	" " " Bruck, Cilli, Lay-back to Trinte,	284	"
6,	" " " Lintz to Saltzburg,	156	"

7, " Prague to the boundary of Saxony, to connect with the line from Dresden, is nearly complete as far as the boundary of Bohemia, on which Storer's apparatus will be used; on the other a modification of Morse's by Robinson, printing about 600 words per hour; also, a modification of Bain's needle telegraph, by Ekling, of Vienna, containing an arrangement of 45 needles, averaging about 190 words of six letters each per hour. The Austrians have adopted this system of correspondence, mostly since 1847; their network of telegraphs extends over a space of more than 1053 miles, having 106 stations, which will be increased to 200 stations, if the present projected lines are constructed. The line from Lintz to Saltzberg, has a connexion with the Bavarian one from Munich to the latter place, and makes use of Stochriss' instrument. A line between Venice and Milan with its branches is already commenced.

Saxony and Bavaria.

Saxony and Bavaria have government lines which connect with the Prussian and Austrian lines, and establish a communication with Berlin, Dresden, Munich, and Vienna. Nearly all the railroad companies have private lines for their own use, and preparations are now making, which in no distant future will include every town of importance throughout Germany in this network of communication.

Those of Saxony extend over 265 miles, the principal of which are annexed: From Leipzig to Hoff, 94 miles; from Leipzig to Dresden, 62 miles; Dresden to Konigstien, 15 miles; Dresden to the boundary of Bohemia; Dresden to Hoff, 94 miles. Stochriss' needle instrument is principally used in this country; likewise, in Bavaria his bell apparatus. The extent of lines in the latter country is about 455 miles. From Munich to Salzburg, 74 miles, connecting with the Austrian lines of Ling and Vienna; from Munich through Augsburgh to Hoff, 226 miles, connecting with the line to Dresden in Saxony; from Munich to Augsburg, 31 miles; one under construction from Augsburg, through Nuremburgh and Bamburgh to Hoff; from Bamburgh to Wurzburg, Aschappenburg, and Frankfort, 125 miles under construction.

Tuscany.

The lines in Tuscany number 120 Italian miles, commenced in 1847, under the direction of Matteucci; they also follow the railroad. From Florence to Livourne; from Empoli to Sienne; from Pisa to Lucca, and from Florence to Patro; which makes in all, 120 Italian miles, or nearly

60 leagues. The total length of the wires is 121 leagues, weghing 70,000 pounds; 2488 posts.

The expense of placing the wire which cost at first 400 pounds per mile, is reduced to 30 or 40 francs at present, that the wires are placed by the guardians of the telegraph. The telegraphic apparatus is furnished in part by M. Brequet, and part by the constructor of the University, M. Pierncci; a complete apparatus costs 600 livres.

The following is a table of necessary expense for the establishment of the Tuscan lines:—

	Livres.	Sous.	
Iron Wire,	23,348	8	
Posts of fir tree,	21,426	13	4
Tenders,	3,347		
Porcelain shield,	2,627	13	
Wooden box,	1,772	13	4
Furniture, and supplies of the office,	8,183	18	8
Laying of copper wire, varnish,	5,314	13	4
Machines and piles,	26,043	17	
Timber, cost of posts, administration, studies, and superintendance of the work,	3,443	3	4
Total,	95,507	10	

GERMANY.

The telegraph lines of Germany have chiefly been established within the last three years. Gauss and Weber at Gottingen, and Steinhiel at Munich, had short lines of telegraph, in 1834 and 1837; but the railroad companies were the first to make a proper appreciation of them, and establish lines for their own benefit. The first great line along the railway from Mentz to Frankfort, was erected by Fardly, a mechanician of Manheim, with Wheatstone's index apparatus. It was this line that aroused the attention of the Prussian Government, and caused the appointment of a committee to experiment on the matter.

No. 781 of the London *Mining Journal* for 1850, states that 2000 miles of telegraph are already open in Germany, and that 1000 more will be added in 1851; it works now from Cracow to Trieste, a distance of 700 miles, and a general union of the Austrian, Prussian, Saxon, and Bavarian lines was soon expected, with a tariff of charges nearly as low as that of the United States.

(To be Continued.)

Explanation of Diagrams Illustrating the Action of the Forces on the Crank of a Steam Engine. By W. POLE, C. E.*

(*With a Plate.*)

[In the year 1849, the Society of Arts offered a prize "for the best collection of diagrams (with explanations,) to illustrate the action of the forces on a crank or cranks turned from a horizontal direct action steam cylinder or cylinders; the effect of various proportions of connecting rods, and degrees of expansion of steam, being shown."

The present paper was communicated to the Society in accordance with their invitation, and obtained the silver Isis medal. It is now first printed by the joint permission of the Society and the author.]

The 15 diagrams contained in plate II, illustrate the action of the forces

* From the London Journal of Arts and Sciences, April, 1852.

n one and two cranks, turned from horizontal direct action steam cylinders; the effect of various proportions of connecting rods, and degrees of expansion of steam, being shown.

The varieties of expansion taken in these diagrams, are three, viz:

Steam admitted during the whole stroke, (Nos. 4, 5, 6.)
" " half the stroke, (Nos. 7, 8, 9.)
" " one-fourth the stroke, (Nos. 10, 11, 12.)

It has not been thought necessary to exhibit a higher degree of expansion than four times; this limit being seldom exceeded in crank engines.

The varieties of length of connecting rod have also been taken at three, viz:

Connecting rod indefinitely long, (supposed to act always in parallel directions.) (Nos. 1, 4, 7, 10.)
Connecting rod five times the length of crank, which may represent about the ordinary length. (Nos. 2, 5, 8, 11.)
Connecting rod three times the length of crank, or about the shortest made. (Nos. 3, 6, 9, 12.)

Diagrams Nos. 1, 2, and 3, are explanatory of the action of the forces, in the transmission of the power from the piston to the crank, for the three varieties in the length of connecting rod respectively. AB is the piston rod, supposed to be propelled forward by a certain pressure of steam, in the direction shown by the arrow. At the joint, B, this pressure resolves into two; one in the direction, BG, (causing the friction on the guide;) the other along the connecting rod, BC; the latter force being = the pressure on piston × secant of angle, CBD. At the crank pin, C, the force acting along the connecting rod, is again resolved into two; one along the crank, CD; the other, the *tangential force*, tending to turn the crank round in the direction, CT. This tangential force is = the force acting along connecting rod × sine of angle BCD.

The object of diagrams Nos. 4 to 12, is to exhibit the values and variations of the first and last named forces; or, so to speak, the forces at the beginning and end of the engine; *i. e.*, the pressure of steam on the piston, and the force turning the crank round.

Each of these diagrams contains two figures. The left hand figure shows the pressure on the piston at all points of the stroke, on the plan of rectangular co-ordinates; the abscissa representing the space passed over by the piston, and the ordinate the corresponding pressure. Thus, when the piston has moved from 0 to x, No. 8, or $\frac{7}{10}$ths of the whole stroke, the steam pressure upon it is represented by the line, xy. The scale given under the left hand figure, in Nos. 4, 5, 6, and which also applies to Nos. 7 to 12, shows the position of the crank corresponding to any given position of the piston; thus, in No. 6, it is seen, by inspection, that when the piston has passed through $\frac{5}{10}$ths of its course, the crank has passed through about 81° from the dead point; and so on.

The right hand figure in each diagram represents the tangential or working force, acting on the crank pin, at every point of its semi-revolution from E to F, Nos. 1, 2, and 3. The curve of this figure is also laid down by rectangular co-ordinates: the path of the crank pin (reduced to a straight line,) forms the line of the abscissæ, while the ordinates express the corresponding forces. Thus, in fig. 5, when the crank pin has moved

from 0 to θ, or 120° from the dead point, the tangential force tending to turn it round, is represented by the line θp.

The additional scale, under this figure, shows the position of the piston corresponding to any given position of the crank; thus, in fig. 5, when the crank is at 140°, the piston has moved through $\frac{9}{10}$ths of its stroke, and so on.

The lines representing the forces are measured by a scale, which is appended to fig. 4. The pressure of the steam upon the piston, while the steam valve is open, is made = 100 on the scale; and the ratio of any other force to this pressure is therefore easily ascertained by simple measurement.

Diagrams 4, 5, and 6, show the values of the forces when the steam is admitted during the whole stroke.

In No. 4, the connecting rod is supposed indefinitely long; the pressure on the piston is uniform at 100. The tangential force on the crank pin begins at 0 when the crank is at the dead point; increases to 100 when it arrives at 90°; and diminishes again to 0, in the same ratio as the increase. The mean value of the force, throughout the semi-revolution, is = 63·6, which, × the space passed through by the crank pin, is exactly = the pressure on the piston × the length of its stroke; or, in other words, the area of the figure *efg*=the parallelogram *abcd*. This result is in accordance with the principle of "conservation of *vis viva*," by which we know that, (neglecting friction,) the amount of power or work given out at the crank pin is equal to that performed by the steam on the piston.

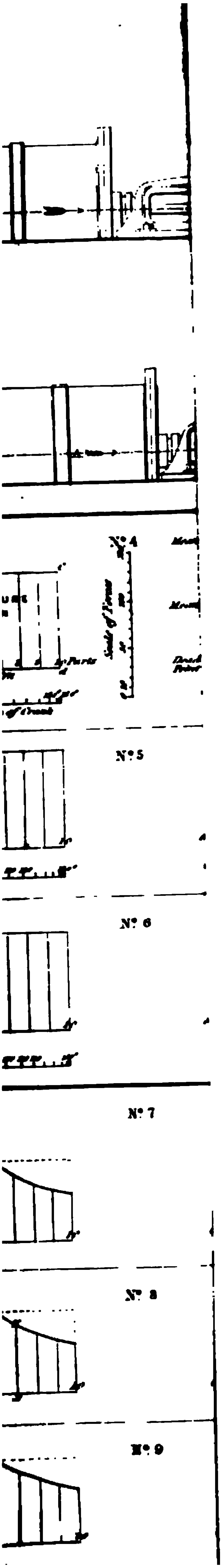
In No. 5 is seen the effect of the connecting rod being made five times the length of the crank. Here the tangential force commencing at 0, arrives at a maximum value of about 102 when the crank has passed through about 80°.

In No. 6, where the connecting rod is three times the length of the crank, the tangential force arrives at a maximum value of about 106 when the crank has passed through about 75°.

It will be perceived, however, that these variations make no difference in the mean force throughout the whole figure, the effect of the connecting rod being merely to vary, in a slight degree, the distribution of the force over the path of the crank pin, without affecting the total amount of power conveyed by it to the machinery. The comparative merits of long and short connecting rods in other points of view, involve considerations which it would be out of place to introduce here.

The return stroke, or the other semi-revolution of the crank, does not exactly correspond with the figures shown in diagrams, 5 and 6, owing to the reversed position of the connecting rod. The nature of the variation will be seen in fig. 6*, where the tangential force is shown for an entire revolution of the crank. It will be observed here, that the force at 10° corresponds with that at 350°, at 60° with 300°, and so on.

Nos. 7, 8, 9, show the effect of cutting off the steam at half the stroke. Here the mean pressure on the piston is = 84·6, and the mean tangential force on the crank pin is = 54,—the equality between the areas of the right and left hand figures being still preserved. The power of the engine is diminished in the proportion of 1000 : 846, although the economy is much increased, as is well known.



Nº 4
Nº 5
Nº 6
Nº 7
Nº 8
Nº 9

Nos. 10, 11, 12, show the effect of cutting off the steam at one-fourth of the stroke. Here the mean pressure on the piston is = 59·6, the mean tangential force is = 38; and the power of the engine is reduced from 100 to 59·6.

Nos. 9*, and 12*, show the values of the tangential force through an entire revolution of the crank, in the cases above alluded to under corresponding numbers.

Combined Action of two Engines, with Cranks fixed at right angles to each other.

The effect of two engines, so coupled, is shown in six cases out of the nine previously described; namely, with three variations in the degree of expansion, and two in the length of connecting rod. The curve of tangential forces is laid down for two cranks in diagrams Nos. 4, 7, 10, 6*, 9*, and 12*; in the three former, for half a revolution, (the other half being precisely similar,) and in the three latter, for a whole revolution of the crank.

It is presumed that these figures will be understood without any further description. As an example, at θ, (No. 9*,) one crank is supposed to have traveled 130° from the dead point, E, (No. 3,) the tangential force on it being expressed by the line, $\theta\rho^1$: the second crank will then have traveled 220° from the same point; and the combined tangential force will be represented by the line, $\theta\rho^2$. The undulations of the upper line will therefore represent the inequalities of the working power in the crank shaft throughout its whole revolution.

Method of Construction of the Diagrams.

In laying down the forces in these diagrams, the following points have been assumed:—

(*a.*) That, as long as the steam valve remains open, the pressure of the steam in the cylinder is uniform. This is not always the case in practice, but must generally be assumed in calculation.

(*b.*) That, after the steam valve is closed, the steam expands according to Marriotte's law, the pressure varying inversely as the volume. This is the usual assumption: the causes of variation from this law are treated of in works on the steam engine, but cannot be comprehended in an investigation of the present nature.

(*c.*) That no power is lost by friction, in the transmission of the force through the machine.

(*d.*) The influence of the clearance space on the volume of the steam, in expanding, has been neglected. This is but of small moment, and its introduction would have interfered materially with the simplicity and clearness of the diagrams.

(*e.*) The moving parts are supposed to have no weight or mass; the forces being considered in a statical point of view only.

The curves have been formed by finding the length of ordinates at convenient distances apart, and tracing a curved line through the points thus obtained.

The left hand figures in diagrams Nos. 4 to 12, representing the pres-

sures on the piston, are so simple, that the method of their construction need not be further alluded to than by stating, that the expansion curve, in figs. 7 to 12, is a hyperbola; the property of which is, that (in fig. 8,)

$$\text{As } ox : ol :: lp : xy$$

which follows from Marriotte's law.

The lengths of the ordinates in the right hand figures (the tangential forces) have been found in the following manner:—

Let Nos. 2 and 3, represent a given position of the engine. Draw the tangent, CT. Produce the line of connecting rod, BC; draw CH parallel to AD, and set off CH = the pressure on the piston at that position of the engine. Draw HJ perpendicular to CH; and from the point, J, where it cuts the line of connecting rod, draw JT, parallel to DC, cutting the tangent, CT, in T; then CJ is = the force along the connecting rod, and CT is = the tangential force on the crank pin, which is the ordinate required.

The curves in the diagrams may be expressed by algebraical equations, as follows:—

For the pressure of steam on the piston, in expanding, as shown in the left hand figures, Nos. 7 to 12. Let the pressure on the piston, while the steam valve is open, = P; and let l = length of stroke passed over before the steam valve is closed. Then, if x = any length passed over greater than l, and y = the corresponding pressure, we have, by Marriotte's law—

$$y = P\frac{l}{x}.$$

For the tangential force on crank pin, as shown on the right hand figures, Nos. 4 to 12. Referring again to diagrams Nos. 2 and 3, let

r = CD, the radius of crank,
c = BC, length of connecting rod,
θ = angle CDE,
ϕ = angle CBE,
z = force acting along connecting rod,
f = tangential force required (=CT).

Then, by statical rules, we have, while the steam valve is open,

$$z = P \text{ Sec } \phi,$$
$$\text{and } f = z \text{ Sin (BCD)};$$

whence, after making all necessary trigonometrical reductions, we arrive at the equation required:

$$f = P \text{ Sin } \theta \left\{ 1 + \frac{\text{Cos } \theta}{\sqrt{\frac{c^2}{r^2} - \text{Sin}^2 \theta}} \right\}$$

After the steam is cut off, and the pressure in the cylinder becomes variable, we have

$$\text{Pressure on piston} = P\frac{l}{c + r \text{ Vers } \theta - \sqrt{c^2 - r^2 \text{ Sin}^2 \theta}};$$ which must be substituted for P in the preceding equation.

On Electro-Magnetic Clocks. By Prof. Brande.*

Mr. Brande began by adverting to the various opinions which had been entertained in reference to the mutual relations of electricity and magnetism previous to the grand discovery of Oersted, in 1819. As soon as the influence of an electrical current upon a magnetic needle had been developed by the researches of that philosopher, many important applications of the fact almost of necessity suggested themselves, amongst which the wonders of the electric telegraph were to be included. Another result of Oersted's discovery was the electro-magnet; the power, namely, of conferring by proper adjustments of an electric current any degree of magnetism upon a bar of soft iron: and inasmuch as these magnetic energies cease the moment that the electric current ceases, so we have it in our power to render any convenient form of soft iron, such as bars, or horse-shoes, powerful magnets at one moment, and at the next, entirely withdraw all their powers; and this, simply by making and breaking the contacts upon which the flow of electricity from voltaic arrangement depends. In this way a horse-shoe magnet was made alternately to lift and drop a weight, to raise and depress a loaded lever, and to bend and release a spring. These effects were merely due to the attractive force of the electro-magnet upon holders and bars of soft iron, with proper contrivances to prevent the interfering influence of the residuary magnetism which in such cases is more or less retained by the iron core of the coil. Another form of this application of electro-magnetism as a motive power consists in so arranging the electro-magnets that the poles may be alternately inverted, and so made to act upon adjacent permanent bar magnets, both attractively and repulsively. These forms of the apparatus were exhibited. Mr. Brande then stated that on examining Mr. Shepherd's electro-magnetic clocks at the Great Exhibition, he had been especially struck by the excellent illustration which they afforded of the exclusive use of electro-magnetism as their moving power, its force being employed to give impulse to the pendulum, to propel the ordinary movement of the clock, and to effect the striking of the hour; no auxiliary weights or springs being in any case employed. Thinking the whole subject worthy the attention of the members of the Royal Institution, he had applied to Mr. Shepherd for such information and assistance as he required, and Mr. Shepherd had furnished him with the pendulums, clocks, models, and diagrams then before them, and with most useful information in reference to the whole subject. Mr. Brande first explained the mechanism of the pendulum, which is so arranged as to make and break an electric circuit, and consequently to make and unmake a horse-shoe magnet at each vibration. Each time that the magnet is made it attracts its armature, which lifts certain levers; one of these is concerned in raising a weighted lever and causing it to be held up by a latch or detent; the magnet is then unmade in consequence of the pendulum breaking the circuit, and the armature is released, when the pendulum lifts the latch, and allows the weighted lever to fall, which, in falling, strikes the pendulum so as to give it an adequate impulse; then the circuit is again completed, the

* From the London Atheneum, February, 1852.

armature attracted, the levers moved, the weight raised and held up by the detent; another vibration breaks the circuit and releases the armature; the pendulum then raises the detent, the weight falls, and in falling, its arm strikes the pendulum, and gives it an impulse; and so on. But the pendulum at each vibration not only makes and breaks the electric circuit of the battery which maintains its own action, but also, and simultaneously, that of a second battery, of which the duty is to make and unmake the electro-magnets belonging exclusively to the clock or clocks which are upon this circuit. These electro-magnets act upon the extremes of one or more horizontal bar magnets, so as alternately to attract and repel their opposed poles, and which carry upon their axis the pallets, by the alternating motion of which to the right and left, the ratchet wheel is propelled onwards at the rate of a tooth each second, and the axis of this ratchet wheel carries the pinion which moves the other wheels of the clock. The circuit of the battery connected with the striking part of the clock is only completed once in an hour, and is connected with an electro-magnet so arranged as by means of a proper lever to pull the ratchet wheel attached to the notched striking wheel one tooth forward every two seconds, and each tooth is accompanied by a blow on the electro-magnetic bell. The number of blows depends upon the notched wheel, the spaces on the circumference of which are adapted to the number to be struck, and when this is complete, a lever falls into the notch, and in so doing cuts off the electric current, which is not re-established through the striking electro-magnet till the next hour, when a peg upon the hour wheel pushes the striking lever forward so as to cause it to be depressed by a similar peg upon the minute wheel. A very large working model of the clock and of the striking apparatus, constructed for the occasion by Mr. Shepherd, was exhibited, as well as a model of the pendulum and its appendages made under the direction of Mr. C. V. Walter, to whom Mr. Brande was also indebted for a signal bell, on the principle of Mr. Shepherd's clock bells, for the purpose of giving notice to the railway switchmen of the approach of trains in foggy weather.

Contributions to the Physiology of Vision.—Part II.—On some Remarkable, and hitherto unobserved, Phenomena of Binocular Vision. A Bakerian Lecture, delivered by Charles Wheatstone, Esq., F. R. S.*

The first part of these researches was communicated to the Royal Society in 1838, and published in the Philosophical Transactions for that year.

The second part, now presented, commences with an account of some remarkable illusions which occur when the usual relations which subsist between the magnitude of the pictures on the retinæ and the degree of inclination of the optic axes are disturbed. Under the ordinary circumstances of vision, when an object changes its distance from the observer, the magnitude of the pictures on the retinæ increases at the same time that the inclination of the optic axes becomes greater, and *vice versa*, and the perceived magnitude of the object remains the same. The author

* From the London, Edinburgh, and Dublin Philos. Mag., Feb., 1852.

wished to ascertain what would take place by causing the optic axes to assume every degree of convergence while the magnitude of the pictures on the retinæ remains the same; and, on the other hand, the phenomena which would be exhibited by maintaining the inclination of the optic axes constant while the magnitude of the pictures on the retinæ continually changes. To effect these purposes, he constructed a modification of his reflecting stereoscope; in this instrument two similar pictures are placed, on movable arms, each opposite its respective mirror; these arms move round a common centre in such manner that, however they are placed, the reflected images of each picture in the mirror remains constantly at the same distance from the eye by which it is viewed; the pictures are also capable of sliding along these arms, so that they may be simultaneously brought nearer to, or removed further from, the mirrors. When the pictures remain at the same distance and the arms are removed round their centre, the reflected images, while their distances from the eyes remain unchanged, are displaced, so that a different inclination of the optic axes is required to cause them to coincide. When the arms remain in the same positions and the pictures are brought simultaneously nearer the mirrors, the reflected images are not displaced, and they always coincide with the same convergence of the optic axes; but the magnitude of the pictures on the retinæ becomes greater as the pictures approach. The experimental results afforded by this apparatus, so far as regards the perception of magnitude, are the following: the pictures being placed at such distances, and the arms moved to such positions, that the binocular image appears of its natural magnitude and its proper distance, on the arms being moved so as to occasion the optic axes to converge less, the image appears larger, and on their being moved so as to cause the optic axes to converge more, the image appears less; thus, while the magnitude of the pictures on the retinæ remains constantly the same, the perceived magnitude of the object varies, through a very considerable range, with every degree of the convergence of the optic axes. The pictures and arms being again placed so that the magnitude and distance of the object appear the same as usual, and the arms being fixed so that the convergence of the optic axes does not change; while the pictures are brought nearer the mirrors the perceived magnitude of the object increases, and it decreases when they are removed further off; thus, while the inclination of the optic axes remains constant, the perceived magnitude of the object varies with every change in the magnitude of the pictures on the retinæ. After this, the author takes into consideration the disturbances produced in our perception of distance under the same circumstances, and concludes that the facts thus experimentally ascertained regarding the perceptions of magnitude and distance, render necessary some modification in the prevalent theory regarding them.

The author next reverts to the stereoscope and its effects. He recommends the original reflecting stereoscope as the most efficient instrument, not only for investigating the phenomena of binocular vision, but also for exhibiting the greatest variety of stereoscopic effects, as it admits of every required adjustment, and pictures of any size may be placed in it. A very portable form of this instrument is then described, and also a refracting stereoscope suited for daguerreotypes and small pictures not much exceeding the width between the eyes. In the latter instrument the pictures

are placed side by side, and viewed through two refracting prisms of small angle, which displace the pictures laterally, that on the right side towards the left, and that on the left side towards the right, so that they appear to occupy the same place. When the first part of these investigations was published the photographic art was unknown, and the illustrations of the stereoscope were confined to outline and shaded perspective drawings; when, however, in the succeeding year, Talbot and Daguerre made their processes known, Mr. Wheatstone was enabled to obtain binocular talbotypes and daguerreotypes of statues, buildings, and even portraits of living persons; which, when presented in the stereoscope, no longer appeared as pictures, but as solid models of the objects from which they were taken. This application was first announced in 1841.

The two projections of an object, seen by the two eyes, are different according to the distance at which it is viewed; they become less dissimilar as that distance is greater, and, consequently, as the convergence of the optic axes becomes less. To a particular distance belongs a specific dissimilarity between the two pictures, and it is a point of interest to determine what would take place on viewing a pair of stereoscopic pictures with a different inclination of the optic axes than that for which they were intended. The result of this inquiry is, that if a pair of very dissimilar pictures is seen when the optic axes are nearly parallel, the distances between the near and remote points of the object appear exaggerated; and if, on the other hand, a pair of pictures slightly dissimilar is seen when the optic axes converge very much, the appearance is that of a bas-relief. As no disagreeable or obviously incongruous effect is produced when two pictures, intended for a nearer convergence of the optic axes, are seen when the eyes are parallel or nearly so, we are able to avail ourselves of the means of augmenting the perceived magnitude of the binocular image mentioned at the commencement of this abstract. For this purpose the pictures, placed near the eyes, are caused to coincide when the optic axes are nearly parallel; and the diverging rays proceeding from the near pictures are rendered parallel by lenses of short focal distance placed before the mirrors or prisms of the stereoscope.

Some additional observations were next brought forward respecting those stereoscopic phenomena which the author, in his first memoir, called "conversions of relief." They may be produced in three different ways: 1st, by transposing the pictures from one eye to the other; 2d, by reflecting each picture separately, without transposition; and 3d, by inverting the pictures to each eye separately. The converse figure differs from the normal figure in this circumstance, that those points which appear most distant in the latter, are the nearest in the former, and *vice versa*.

An account is then given of the construction and effects of an instrument for producing the conversion of the relief of any solid object to which it is directed. As this instrument conveys to the mind false perceptions of all external objects, the author calls it a Pseudoscope. It consists of two reflecting prisms, placed in a frame, with adjustments, so that, when applied to the eyes, each eye may separately see the reflected image of the projection which usually falls on that eye. This is not the case when the reflection of an object is seen in a mirror; for then, not only are the projections separately reflected, but they are also transposed from one eye to the other, and therefore the conversion of relief does not

take place. The pseudoscope being directed to an object, and adjusted so that the object shall appear of its proper size and at its usual distance, the distances of all other objects are inverted; all nearer objects appear more distant, and all more distant objects nearer. The conversion of relief of an object consists in the transposition of the distances of the points which compose it. With the pseudoscope we have a glance, as it were, into another visible world, in which external objects and our internal perceptions have no longer their habitual relations with each other. Among the remarkable illusions it occasions, the following were mentioned. The inside of a tea cup appears a solid convex body; the effect is more striking if there are painted figures within the cup. A china vase, ornamented with colored flowers in relief, appears to be a vertical section of the interior of the vase, with painted hollow impressions of the flowers. A small terrestrial globe appears a concave hemisphere; when the globe is turned on its axis, the appearance and disappearance of different portions of the map on its concave surface has a very singular effect. A bust regarded in front becomes a deep hollow mask; when regarded *en profile*, the appearance is equally striking. A framed picture, hung against a wall, appears as if imbedded in a cavity made in the wall. An object placed before the wall of a room appears behind the wall, and as if an aperture of the proper dimensions had been made to allow it to be seen; if the object be illuminated by a candle, its shadow appears as far before the object as it actually is behind it.

The communication concludes with a variety of details relating to the conditions on which these phenomena depend, and with a description of some other methods of producing the pseudoscopic appearances.

On a Method of Obtaining a Perfect Vacuum in the Receiver of an Air Pump. By THOMAS ANDREWS, M. D.*

By using the necessary precautions, a vacuum may be obtained by the following process, with very little trouble, in the ordinary receiver of an air pump, so perfect that the residual air exerts no appreciable elastic force. Even after this limit has been reached, the exhaustion may be pushed still further, till it must become at last not less complete than the Torricellian vacuum; while at the same time, by suppressing the manometer, the existence of mercurial vapor may be altogether prevented. The manipulations required to arrive at this result will not interfere with the presence of the most delicate instruments in the receiver.

Into the receiver of an ordinary air pump, which is not required to exhaust further than to 0·3 inch, or even 0·5 inch, but which must retain the exhaustion perfectly for any length of time, two open vessels are introduced, one of which may be conveniently placed above the other; the lower vessel containing concentrated sulphuric acid, the upper a thin layer of a solution of caustic potash, which has been recently concentrated by ebullition. The precise quantities of these liquids is not a matter of importance, provided they are so adjusted that the acid is capable of desiccating completely the potash solution without becoming itself notably diminished in strength, but at the same time does not expose so

* From the London, Edinburgh, and Dublin Philosophical Magazine, February, 1852.

large a surface as to convert the potash into a dry mass in less than five or six hours at the least. The pump is in the first place worked till the air in the receiver has an elastic force of 0·3 or 0·4 inch, and the stop-cock below the plate is then closed. A communication is now established between the tube for admitting air below the valves and a gas-holder containing carbonic acid, which has been carefully prepared so as to exclude the presence of atmospheric air. After all the air has been completely removed from the connecting tubes by alternately exhausting and admitting carbonic acid, the stop-cock below the plate is opened and the carbonic acid allowed to pass into the receiver. The exhaustion is again quickly performed to about the extent of half an inch or less. If a very perfect vacuum is desired, this operation may be again repeated; and if extreme accuracy is required, it may be performed a third time. It is not likely that any thing could be gained by carrying the process further. On leaving the apparatus to itself, the carbonic acid which has displaced the residual air is absorbed by the alkaline solution, and the aqueous vapor is afterwards removed by sulphuric acid. The vacuum thus obtained is so perfect, that even after two operations it exercises no appreciable tension.

To give a clear conception of the progress of the absorption, I will describe in detail one observation in which the tension was measured simultaneously by a good syphon-gauge and by a manometer, formed of a barometric tube 0·5 inch in diameter, inverted in the same reservoir of mercury as a similar tube communicating with the interior of the receiver. The barometer had been carefully filled, and the depression of the mercury estimated by the method already described at less than $\frac{1}{1000}$dth of an inch.

Previous to the admission of the carbonic acid, the exhaustion was carried only to 0·4 inch; it was again carried to 1 inch; and a third time to 0·5 inch, after which the apparatus was left to itself. The manometer indicated a pressure in—

15′ of 0·25 inch.
30′ " 0·17 "
80′ " 0·10 "
200′ " 0·02 "

In twelve hours the difference of level was just perceptible, when a perfectly level surface was brought down behind the tubes till the light was just excluded. In thirty-six hours not the slightest difference of level could be detected. The vacuum has remained without the slightest change for fourteen days.

It is evident that the only limit to the completeness of the vacuum obtained by this process, arises from the difficulty of preparing carbonic acid gas perfectly free from air. This may be very nearly overcome by adopting precautions which are well known to practical chemists. When an extreme exhaustion is required, the gas-holder should be filled with recently boiled water, and the first portions of carbonic acid that are collected in it should be allowed to escape.

The substitution of phosphoric for sulphuric acid would remove the possibility of either aqueous or acid vapors being present even in the smallest amount, but such a refinement will rarely be found necessary.

In the experiment just described, the theoretical residue of air would be $\frac{1}{135{\cdot}000}$dth part of the entire quantity in the receiver, which would cause a depression of $\frac{1}{4500}$dth of an inch. This result must have been nearly realized. If the exhaustion had been carried at each time to 0·2 inch, the residue by theory would have been only $\frac{1}{3{\cdot}375{\cdot}000}$dth part. But the experimental results will not continue to keep pace with such small magnitudes.

Queen's College, Belfast, January 7, 1851.

Chemical Report on the Cause of the Fire in the Amazon. By Professor GRAHAM.*

In reply to the questions arising out of the disastrous loss of the *Amazon* by fire, which are proposed to me for a Chemical opinion, I beg to submit to your Lordships the following statements and conclusions:

The practice of mixing together the various stores of the engineer, consisting of oils, tallow, soft-soap, turpentine, cotton waste, and tow, and placing them in heated store-rooms contiguous to the boilers, must be looked upon as dangerous in no ordinary degree, for several reasons. Although oil in bulk is not easily ignited, particularly when preserved in iron tanks, still, when spilt upon wood, or imbibed by tow and cotton waste, which expose much surface to air, the oil often oxidates and heats spontaneously, and is allowed to be one of the most frequent causes of accidental fires. The vegetable and drying oils used by painters are most liable to spontaneous ignition; but no kind of animal or vegetable oil or grease appears to be exempted from it; and instances could be given of olive oil igniting upon sawdust; of greasy rags from butter, heaped together, taking fire within a period of twenty-four hours; of the spontaneous combustion of tape-measures, which are covered with an oil varnish, when heaped together; and even of an oil-skin umbrella put aside in a damp state. The ignition of such materials has been often observed to be greatly favored by a slight warmth, such as the heat of the sun. I am also informed by Mr. Braidwood,'that the great proportion of fires at railway stations have originated in the lamp store, and that in coach works also, when the fire can be traced, it is most frequently to the painter's department, the fire having arisen spontaneously from the ignition of oily matters. Lamp-black and ground charcoal are still more inflammable, when the smallest quantity of oil obtains access to them, and should not be admitted at all among ships' stores.

The stowing metallic cans or stoneware jars of either oil or turpentine in a warm place is also attended with a danger which is less obvious, namely, the starting of the corks of the vessels, or the actual bursting of them by the great expansion of the liquid oil which is caused by heat. These liquids expand in volume so much as one upon thirty by a rise of not more than 60° of temperature, or by such a change as from the ordinary low temperature of 40° to a blood-heat; the latter temperature may easily be exceeded in an engine room. It is remarkable that the burning a few years ago of a large steamer on the American lakes, which

* From the Journal of the London Chemical Society, April, 1852.

even surpassed in its fatality the loss of the *Amazon*, was occasioned by the bursting, in the manner described, of a jar of turpentine placed upon deck too close to the funnel, by a party of journeymen painters who were passengers. This steamer was also on her first voyage, and being newly varnished, the flames spread over her bulwarks and extended the whole length of the vessel in a few minutes.

The bulkheads of coal-holds appear to admit of obtaining considerable security from fire, by being constructed double where close to the boiler, with a sheet of air between the two partitions. The tendency of coals to spontaneous ignition is increased by a moderate heat, such as that of the engine room, from which they would be protected by the double partition. I have obtained instances where coals took fire in a factory, on two different occasions, by being heaped for a length of time against a heated wall, of which the temperature could be supported by the hand; also of coals igniting after some days upon stone flags covering a flue, of which the temperature was not known to rise above 150°, and of coals showing indications of taking fire by being thrown in bulk over a steam pipe. These were Lancashire coals, which are highly sulphurous; but the same accident occurred with Wallsend coals, at the Chartered East Company's works in London, where the coals were twice ignited through a two-feet brick wall, of which the temperature was believed by Mr. Croll not to exceed 120° or 140°.

The surface of deal in the partition opposed to the boiler would probably be better protected from fire by impregnating the wood with a saline solution, which diminishes combustibility, such as the zinc solution of Sir W. Burnett, rather than by coating the wood on the side next the boiler with sheet iron. Indeed, this use of iron appears to introduce a new danger. The iron being a good conductor of heat, the wood below is heated nearly as much as if uncovered, and wood in contact with iron appears to be brought by repeated heating to an extraordinary degree of combustibility, and to become peculiarly liable to spontaneous ignition.

Mr. Braidwood, who has been led to that conclusion, gave an instance of wood covered by sheet iron igniting spontaneously in a wadding manufactory. The numerous occasions, also, on which wood and paper have been ignited by Perkins' heated water pipes, equally exemplify the dangerous consequences which may arise from moderately heated iron in long contact with combustible matter.

The most obvious precautions for guarding against the spontaneous ignition of coal stowed in ships' bunkers, appear to be the taking the coal on board in as dry a condition as possible, and the turning it over, if there is room for doing so, as soon as the first symptom of heating is perceived. An obnoxious vapor is described as always preceding the breaking out of the fire, and affords warning of the danger. The ignition of Newcastle coals in store is not an unfrequent occurrence at the London gas works. It appears always to begin at a single spot, and is met by cutting down upon and removing at once the heated coals. Long iron rods are placed upright in the coal heap, which can be pulled out, and indicate by their warmth the exact situation of the fire. Steam can be of little avail for extinguishing fire among coals in bulk; and water, although

it may extinguish the fire for the time, is too apt to induce a recurrence of the evil.

For extinguishing a fire occurring in berths or cabins in the immediate vicinity of the boiler and engine room, steam might be more advantageously applied, means of turning on the steam being provided upon the upper deck, or other distant place of safety. Steam, however, can only be said to be efficient in extinguishing flame, or a blaze from light objects, and is not to be relied upon beyond an early stage of a fire. Upon a mass of red-hot cinders, the extinguishing effect of steam is insensible.

An essential condition of applying steam with success to the extinction of a fire in the engine room, would be to prevent the rapid ingress and circulation of air at the same time, which is occasioned by the draught of the fires. This could only be done completely by valving the chimnies; for the quantity of heated air passing off by the funnels greatly exceeds in volume the steam produced by the boilers in the same time, and would rapidly convey away the steam thrown into the atmosphere of the engine room, and prevent any possible advantage from it.

The fire in the *Amazon* appeared to the witnesses to take its rise either in the small oil store room situated over the boiler, or in a narrow space of from three to eleven inches in width, between a bulkhead and the side of the boiler, immediately under the same store room. No substance remarkable for spontaneous ignition, such as oiled cotton waste, was actually observed in the store room or the space referred to. The wood itself of the bulkhead, which was within a few inches of the boiler, may have been highly dried and sensibly heated by its proximity to the latter, but is not likely to have acquired any tendency to spontaneous ignition; for when that property results from low heating, it is an effect of time, requiring weeks or months to develope it. The same observation applies to the decks in contact with the steam-chest which incased the base of the funnel.

Nor does it appear probable that the coals in the coal-hold of the vessel gave occasion to the fire by heating of themselves, and then burning through the wooden partition of the oil store with which they were in contact.

These coals were from Wales, and not remarkable for this property.

They are also said to have been shipped in a dry and dusty state, and not damp, a month or two previously.

Their ignition would also have been preceded by the strong odor before referred to, which does not appear to have been remarked, although the coal-hold communicated directly with the boiler room.

Oil was seen to drop from the floor of the store room upon the top of the boiler, but not in greater quantity than might be accidentally spilt in drawing the oil from the tank for the use of the engineers.

A parcel of twenty-five newly tarred coal-sacks, which had been thrown upon the boiler, also obtained, it is supposed, some of the same oil. This oil appears to be the matter most liable to the possibility of spontaneous ignition, which was noticed near the spot where the fire commenced.

But the sudden and powerful burst of flame from the store room, which

occurred at the very outset of the conflagration, suggests strongly the intervention of a *volatile* combustible, such as turpentine, although the presence of a tin can of that substance in the store room appears to be left uncertain. It was stated to be there by two witnesses, but its presence is denied by a third witness. I find upon trial, that the vapor given off by oil of turpentine is sufficiently dense, at a temperature somewhat below 110°, to make air explosive upon the approach of a light. Any escape of turpentine from the heated store room would therefore endanger a spread of flame, by the vapor communicating with the lamps burning at the time in the boiler room, or even with the fire of the furnaces.

The fire appears not to have begun in the tarred sacks lying upon the boiler, although from their position, which was close to the store room, they must have been very early involved in the conflagration, and contributed materially to its intensity. The sacks appear to have been charged each with about two pounds of tar, thus furnishing together fifty pounds of that substance, in a condition the most favorable that can be imagined for rapid combustion. The freshness of the tar and its high temperature would make it ignite by the least spark of flame, although not prone to spontaneous ignition. The burning of a group of newly tarred cottages in Deptford, which came under the notice of Mr. Braidwood, arose from their being set on fire by lightning, while the sun was shining upon them, and the tar liquefied by the heat.

The origin of the fire must remain, I believe, a subject of speculation and conjecture; but the extreme intensity and fearfully rapid spread of the combustion, are circumstances of scarcely inferior interest, which are not involved in the same obscurity.

The timber of the bulkheads and decks near the engine room is reported to have been of Dantzic red wood, or Riga pine, and such was the character of a portion of the *Amazon's* timber which was supplied to me for chemical examination. The wood has had its turpentine drawn off, and differs in that respect from pitch pine. The Dantzic red wood is, in consequence, less combustible than pitch pine, but more porous and spongy. Oil-paint is absorbed, and dries more quickly upon this porous wood than upon oak and other dense woods. After their paint is well dried, pine and other woods certainly acquire from it some protection from the action of feeble and transient flames, which might kindle the naked wood. But the effect of paint, especially of fresh paint, appears to be quite the reverse, when the wood is exposed to a strong although merely passing burst of flame. The paint melts and emits an oily vapor, which nourishes the flame, and soon fixes it upon the wood. There can be no doubt, therefore, that the timber of the *Amazon* was in a more inflammable state than ship timber usually is, from being recently painted, and also probably from its newness and comparative dryness.

But the circumstance which appears above all others to give a character to the fire in the *Amazon* was its occurrence, not in a close hold or cabin, but in a compartment of the vessel where a vigorous circulation of air is maintained by the action of the boiler fires and their chimnies. The air of the engine room must be renewed under this influence every few minutes, and would be so although full of flames rising above deck through the hatchways; for a portion of these flames would always escape

by the funnels, and add to their aspirating power instead of diminishing it. The combustion of bulkheads or decks once commenced in this situation would therefore be fanned into activity and powerfully supported.

The destruction of the floor of the oil store room, and the overturning, in consequence, of the oil tanks and combustibles into the well of the boiler room, was probably the crisis of the fire. A mass of combustible vapor would speedily be generated, and shot about on all sides, of which the kindling power upon the new and painted timber of the bulkheads and decks would be wholly irresistible.

The burning of the *Amazon* impresses most emphatically the dangerous and uncontrollable character of a fire arising in the engine or boiler room, where the combustion is animated by a steady and powerful circulation of air, and the danger of collecting combustible matter together in such a place. The removal of the oil stores to a safer locality is, fortunately, generally practicable, and is the measure best calculated to prevent the recurrence of any similar catastrophe.—*Feb.* 17, 1852.

---

*Silesian Iron.**

From notice in the *Times* of the Silesian Exhibition of Arts and Manufactures.

The most extensive display of iron, in all the stages of its manufacture, is sent from the numerous forges or *Hutten* of Count Renard, who alone occupies a large portion of the basement of the building. The quality of the metal produced at his works has secured it a local reputation, though other establishments, as the Laura Works, at Beuthen, produce iron in bar and the larger forms in greater quantity. The Renard Works are unrivalled in the finer sorts, and of hoop iron, nail-rods, wire, cast iron for cooking vessels, steel in many varieties, especially forged steel of the finest quality, there is a most abundant supply. Sheet iron is exhibited from these works of such a degree of tenuity that the leaves can be used for paper. A bookbinder of Breslau has made an album of nothing else, the pages of which turn as flexibly as the finest fabric of linen rags. As yet no extensive application for this form of the metal has been found, but the manager says the material must precede the use for it; perhaps books may hereafter be printed for the tropics on these metallic leaves, and defy the destructive power of ants of any color or strength of forceps. We have only to invent a white ink, and the thing is done. Of the finest sort, the machinery rolls 7040 square feet of what may be called leaf iron from a cwt. of metal. In point of price, however, the Silesian iron cannot compete with English; much is still smelted with wood, and the coal and iron districts lie at great distances from each, so that much capital is consumed by the conveyance of fuel to the works.

* From the London Mechanics' Magazine, June, 1852.

Mixtures for Colored Fires. By Prof. Marchand.*

The following recipes for the preparation of mixtures for colored fires were found among the posthumous papers of the late Prof. Marchand. The materials are rubbed to a fine powder separately, and then mixed with the hand:—

Red.

61 p. c. chlorate of potash.
16 sulphur.
23 carbonate of strontia.

Purple-red.

61 p. c. chlorate of potash.
16 sulphur.
23 chalk.

Rose-red.

61 p. c. chlorate of potash.
16 sulphur.
23 chloride of calcium.

Orange-red.

52 p. c. chlorate of potash.
14 sulphur.
34 chalk.

Yellow.

61 p. c. chlorate of potash.
16 sulphur.
23 dry soda.

or,

50 p. c. nitre.
16 sulphur.
20 soda.
14 gunpowder.

or,

61 p. c. nitre.
17½ sulphur.
20 soda.
1½ charcoal.

Light Blue.

61 p. c. chlorate of potash.
16 sulphur.
23 strongly-calcined alum.

Dark Blue.

60 p. c. chlorate of potash.
16 sulphur.
12 carbonate of copper.
12 alum.

Dark Violet.

60 p. c. chlorate of potash.
16 sulphur.
12 carbonate of potash.
12 alum.

Pale Violet.

54 p. c. chlorate of potash.
14 sulphur.
16 carbonate of potash.
16 alum.

Green.

73 p. c. chlorate of potash.
17 sulphur.
10 boracic acid.

Light Green.

60 p. c. chlorate of potash.
16 sulphur.
24 carbonate of baryta.

For Theatrical Illumination.

White.

64 p. c. nitre.
21 sulphur.
15 gunpowder.

or,

76 p. c. nitre.
22 sulphur.
2 charcoal.

Red.

56 p. c. nitrate of strontian.
24 sulphur.
20 chlorate of potash.

Green.

60 p. c. nitrate of baryta.
22 sulphur.
18 chlorate of potash.

Pink.

20 p. c. sulphur.
32 nitre.
27 chlorate of potash.
20 chalk.
1 charcoal.

Blue.

27 p. c. nitre.
28 chlorate of potash.
15 sulphur.
15 sulphate of potash.
15 ammonio-sulphate of copper.

*From the London Chemical Gazette, May, 1852.

The dark blue is rendered still darker by the addition of some sulphate of potash and ammonio-sulphate of copper.—*Journ. für Prakt. Chem.*, lv. p. 250.

For the Journal of the Franklin Institute.

Steamboats on the Western Waters. By Samuel H. Gilman, Esq.

To the Committee on Publications.

Gentlemen:—My attention has recently been directed to an article in the May number of your *Journal*, "On the Steamboats of the Western Waters of the United States," containing statements, as manifestly unjust to the character of the enterprising spirit and mechanical skill of the West, as developed in its steam navigation, as the writer was manifestly unacquainted with the past and present history of steam navigation on Lake Erie, the river Mississippi, and its tributaries.

If the fact that a peculiar class of steam vessels, existing in one section of our country, having failed to compete successfully with another class, entirely different in their construction, and existing only in another and distant section, is evidence of "a spirit of prejudice and servile imitation," having produced such a failure, then the engineers of the Atlantic cities are the prejudiced and servile imitators, as the history of steam navigation in the West will abundantly show.

During a long period after steam vessels were introduced into the waters of the Western lakes and rivers, low pressure engines were universally used, with a few trifling exceptions; and in 1825, there was but one high pressure steamboat on Lake Erie, where they now constitute the majority; and there is not a single low pressure steamboat now on the Mississippi, or its tributaries, with the exception of three tow boats below New Orleans. Most of the improvements that have been from time to time adopted on the Hudson and other Northern rivers, up to the present day, have proved failures when transferred to the West; steamboats that were among the most successful on the Hudson, when transferred to the Mississippi, were complete failures, in competition with its high pressure boats. The experiment has often been made, and always with the same results; and boats built in New York, expressly for that purpose, were equally unsuccessful; and a multiplicity of ruinous experiments in building boats in the West on improved plans, successfully adopted elsewhere, have resulted in the present high pressure steamboat in general use on the Western rivers.

Such are the existing facts; and the intelligent observer, who is conversant with the elements which compose Western steam navigation, will not look upon the present high pressure steamboat of the West, as a product of ignorance, prejudice, or servile imitation. There are three principal elements which have combined to produce the present Mississippi steamer, and render it far superior, in its own waters, to the more staunch, elegant, safe, and speedy steamers of the Hudson river, viz: first, the character of the rivers: second, the materials of which boats are constructed; third, the traffic which supports them.

The rivers, especially all the lower ones, flowing through a delta of soft,

alluvial deposit, are exceedingly tortuous, and constantly changing their channels, by cutting away on one side, and leaving sand flats and bars on the other, and in the place of their former channels; the average velocity of the current was found to be (by the late U. S. Coast Survey, Doc. 20, 1st. Session, 32d Congress,) five miles an hour; and the narrowest places where snags most frequently are encountered, the velocity of the current is seven miles an hour. During the best part of the business season, the rivers are filled with drift wood, composed often of whole trees of the largest class, with all their roots and branches attached; immense flat boats, rafts of logs and lumber, and floating ice, are also among the obstructions; it frequently occurs that a boat, in the tortuosity of its course through these obstructions, is taken by the current and swung on to a sand bar; and during the process of sparring off, the water becomes filled with sand, which, in the use of condensing engines, choked the air pump and condenser to such an extent as to form one of the reasons why they were abandoned. The entire absence of wharves, or regular landing places, renders it necessary to keep the outer wheel in motion, to hold the boat to the shore, while receiving or discharging freight; and when on a downward trip, the swift current obliges the boat to "round to," in landing, which in many places would be impossible with a single engine.

Secondly, the best materials for constructing boats, are of such a nature that it is seldom that a boat is run more than four seasons; the dry rot, and frequent grounding at low water, with the heavy loads carried, break them down; hence, the unfinished and temporary appearance of the cabins, which being always on the upper deck, are palaces in size and comfort, but without the elegant and durable finish of northern and eastern steam vessels.

Thirdly, the traffic that supports them, is almost wholly of a merchandise character, and demands a largely preponderating capacity for freight; the cabin being more an accommodation to travelers than a source of profit to the owners. The shoal water demanding a light draft, with a heavy freight, the flat bottom follows, and superior models for speed are prohibited, with the exceptions of a few short routes between large cities, where the passenger traffic alone has been found remunerative, and where condensing engines might be used successfully during high water. It will therefore readily be seen that, in a boat depending upon a merchandise traffic, any excessive weight, or room occupied by machinery, is a constantly accumulating loss, unless met by a corresponding gain in the saving of fuel, from which is to be deducted the difference in the price of condensing and non-condensing engines. The following examples, although not as similar in some respects as could be wished, will show the approximative relative sums of loss and gain, in the use of condensing engines, for a Mississippi freight boat:

The *Magnolia*, described in McAlpine's Report, is propelled by two slightly inclined engines, mounted upon timbers, and which weigh, including the wood in the engines and wheels, boilers, and water, 256,000 pounds; when running between New Orleans and Louisville, she makes two trips a month, or sixteen trips in eight months, the usual season of high water. The *South America*, on the Hudson, has one beam engine, of about the same power as the two of the *Magnolia*, which weighs, in-

cluding timber in engines and wheels, boilers and water, 356,000 pounds, or 100,000 pounds more than the *Magnolia's* two. The average price of freight from New Orleans to Louisville, being 40 cts. per hundred pounds, the 100,000 pounds extra weight of the condensing engine will be a loss in sixteen round trips of $1000 \times \cdot 40 = 400 \cdot 00 \times 2 = 800 \cdot 00 \times 16 = \$12,800$; to which is to be added $1500 per annum for extra cost of the condensing engine = $14,300 loss by excessive weight of condensing engine per annum; the average cost of the *Magnolia* for fuel per round trip is $1500 × 16 = $24,000; suppose that 30 per cent. were saved by the use of the condensing engine, we should have, at the close of the season of sixteen round trips, 30 per cent. on $24,000 = $7200 saved, and $14,300 lost, or a nett loss of $14,300—7200 = $7100 by the use of the condensing engines. But the actual loss would be much greater, as will be seen by an inspection of the cost for fuel, of carrying one ton one mile in the respective boats, the gain of speed in the *South America* being more than lost by the loss in fuel and freight capacity.

The *Magnolia* carries 1000 tons of freight from New Orleans to Louisville in six days, distance, 1465 miles, against a five mile current; 144 hours $\times$ 5 = $720 + 1460 = 2180$ miles $\div$ 144 hours $= 15 \cdot 13$ miles an hour, average time; burning 70 cords of wood every twenty-four hours, when running up stream, and 40 cords when running down. According to *Bartol's Marine Boilers*, the *Magnolia* is, all things equally compared, a much more economical boat in fuel than boats using condensing engines generally are. I know this is a startling assertion, yet nevertheless true, according to all known data; but why it is so, is not a part of my intentions to discuss in this paper.

The slightly inclined engines, mounted on timbers, are adopted, because of their lightness, cheapness, and compactness; occupying but six feet on each extreme side of the deck, they leave the cabin entirely unbroken, and the centre of the deck is vacant for the passage or stowage of freight; the boilers being entirely forward of the engines; the valves are worked by cams, which give them their entire movement, either opening or closing during one-eighth of the revolution of the main shaft. They are not only allowed to lift high enough to give an area equal to their own, but they are forced to do it; and they are larger in area than the "usual English or our own Eastern practice." The rule given on page 85 of the *Treatise by the Artizan Club*, 3d edition, calls for an area of 23,758 square inches for a cylinder of 30 inches diameter by 10 feet stroke, making 15 revolutions per minute, with a boiler pressure of 125 pounds per square inch; and Haswell's 5th edition, page 213, calls for an area of 44,750 for the same size engine, number of revolutions, and pressure. The *Magnolia's* valves have an area of 56,745 square inches, and the boats described by McAlpine have an area of steam and exhaust valve generally, if not universally, larger than the "usual English or Eastern practice."

The great difference between boiler and cylinder pressure, as shown by your able Collaborator, does not exist to any thing like the extent that he has shown. There may be contractions in the steam pipes to some extent, but none of the engines from which he dated make the number of revolutions as stated; neither do they carry the pressure of

steam in the boilers. All the Pittsburg packets pass my window every trip, during several months of the year, and I frequently note their number of revolutions per minute. I have traveled several thousand miles on the *Magnolia*, and made frequent observations of the speed of her engines, and they average 14 revolutions when going up stream, and but 10 when going down; and their usual working pressure is 100 pounds per square inch by steam gauge; with the boat light, and burning pitch wood, by extraordinary exertions of the firemen, 15 revolutions have been made per minute, with 140 pounds per square inch boiler pressure. But few of the boats have steam gauges; they state the pressure to which the valve is loaded; the actual working pressure being a mere conjecture.

The great necessity of a competent, disinterested, superintending authority, in the management of the propelling power of our boats, every traveler on our rivers fully appreciates: but that it may be exercised through the medium of condensing engines, is what no man conversant with the existing elements can look for. The experience of from twenty to thirty-five years, of some engineers and companies, with high pressure boats, and without accident to their boilers, has established the impression, if not the fact, that with equal restrictions and ability in management, they are equally as safe as the low pressure or condensing engine boats.

Baton Rouge, Louisiana, August 2d, 1852.

Remarks.—We are very glad to hear from our correspondent in defence of the Western Boats; the subject being one which interests every one in our country, and the number of explosions and other fearful accidents with these boats appearing to be largely on the increase: although in view of the late most deplorable and disgraceful sacrifice of the Henry Clay's passengers on the Hudson river, we had better not for the present call the Western kettle, black-face. In the temporary absence from the country, of the gentleman whose remarks have called forth this reply, we will not take issue with Mr. Gilman, in matters which we look upon as of secondary importance, but will call his attention to the point of Mr. Merrick's remarks, which more particularly attracted our notice when the article was published. It is in reference to the extraordinary difference of pressures between the boiler and cylinder. Now what is Mr. M.'s position? He finds in the report of Mr. McAlpine, certain data in reference to the dimensions of the boats and engines of the Mississippi, the pressure of steam which they usually carry, their consumption of fuel, and their speed. Let us observe that this report of Mr. McAlpine is not a mere newspaper article, by one connected with one side or the other, nor even a mere contribution to practical science; but it is the report of a sworn Commissioner, selected from the whole United States for the purpose, to the highest judicial tribunal in our land, and intended to inform and advise that Court in the matter of a suit of no small importance. From such data, then, (which it would seem, ought to secure confidence, if confidence can be given to any statement,) Mr. Merrick proceeded in a manner which is perfectly correct, to calculate the *average working pressure in the* cylinders, and he finds it scarcely one-half of the enormous load which the boilers are required to bear. Following then analogy from

ersal experience, he attributes the faults to a supposed erroneous con-
tion of valve and steam passages, which have been heretofore so
s we know never described in detail. Mr. Gilman denies the data,
the inferences, but we are sure that he will see the necessity of
mulating evidence against data got in such a way. The indicator
sily applicable; will he not take the trouble to have it applied on
ral of the boats (those named in McAlpine's report if possible,) and
s see and publish the cards. That, if fairly done, will settle the
tion.

will then be time enough, if it be considered important, to discuss
tructure and arrangements of the Western boats; but we now freely
ede to Mr. G. that the high pressure boat appears to us the only one
icable to the peculiar navigation of the Mississippi, where low water,
g currents, and inconceivably muddy waters, render the condensing
ne entirely inapplicable. We regret, moreover, the language which
ars to have given offence; it was probably a hasty expression, which
ped the notice of our correspondent, as it did ours, or it would not
been inserted, for epithets, whether true or false, are of no service
discussion of this kind.

'e shall be glad to hear from Mr. Gilman again on this subject.

Ed.

Improved Lucifer Matches.*

essrs. J. and E. Sturge, of Birmingham, are now manufacturing on a
scale, a new description of phosphorus for lucifer matches, (called
rphous phosphorus,) which possesses the following advantages over
old: 1, It involves much less risk of destruction of life and property
re; 2, It is more suitable for matches intended for warm climates;
is not poisonous in the solid form, as that matches made with it
be comparatively harmless if sucked or chewed; and, 4, It does not
off any noxious vapor at ordinary temperature.

he simplest lucifer match consists of a splinter of wood dipped into
ed phosphorus, and then covered with gum or glue. More frequently
phorus is associated with chlorate or nitrate of potass, and with sul-
or sulphuret of antimony. The employment of such materials neces-
y renders the manufacture a very hazardous one, from the risk of fire,
in certain of the Continental states the preparation of lucifer matches
been absolutely prohibited. Another and quite unexpected hazard
soon found to attend their manufacture. The work people were
:ked by a very painful and often fatal disease of the jaw-bones, which
me carious, occasioning in many cases death, in several loss of the
er or under jaw, or other severe mutilation and disfigurement, and
ys much suffering. The German surgeons, who have paid great atten-
to this distressing disease, refer it to the absorption of the vapor of
phorus, given off chiefly during the drying of the matches, but like-
at other stages of the manufacture. Phosphorus, also, is well known
ct as a poison when swallowed in the solid form, and as it occurs in
condition in lucifer matches, fatal accidents have more than once
rred from children sucking them.

he red or amorphous phosphorus is much less combustible than ordi-

* From the London Mechanics' Magazine, June, 1852.

nary phosphorus, and not at all poisonous. To prepare the new substance, ordinary phosphorus is melted in a peculiarly constructed retort, and kept for some hours at a temperature of about 500° Fahr. A very singular change is the result of this heating, during which the phosphorus combines with caloric, and renders it latent, but does not otherwise undergo any chemical alteration. The original phosphorus is a pale yellow or white transparent body, so combustible that it must be kept under cold water, and when brought into the air grows luminous even at the freezing point, and enters into full blaze at a temperature of about 150° Fahr. By the prolonged heating it becomes a soft opaque mass, which is easily pulverised, and then forms an uncrystalline powder of a scarlet, crimson, purple-brown, or brown-black color, so incombustible that it may be exposed in summer in the open air, and handled with impunity; nor does it grow luminons till it is about to enter into full combustion at the temperature of 482° Fahr. It is further so harmless to living creatures, that more than a hundred grains have been given to dogs without doing them any injury. Although in its free state, it is sparingly combustible, yet, when it is mixed with the ordinary ingredients of lucifer matches, such as sulphur or sulphuret of antimony and chlorate of potass, it kindles readily.

On the Composition of Wootz, or Indian Steel. By T. H. HENRY, Esq., F. R. S.*

The high degree of estimation in which wootz has been held in this country appears to rest more upon the supposition that the celebrated scimitars of Damascus were made from this variety of steel, than on any results obtained with it here; for notwithstanding the late Mr. Stodart, an eminent authority, was of opinion that wootz was superior for many purposes to any steel commonly used in this country, the attempts to bring it into use have not been successful, owing, it is said, to the difficulty of working it.

Under these circumstances, it appeared to me desirable to ascertain as accurately as possible the chemical composition of this steel, with the hope of throwing some light upon the causes of its peculiar physical properties.

An examination of wootz was made by Dr. Faraday in the year 1819.† The amount of carbon was not determined by him; the only substances eliminated were silica and alumina; and he obtained in two analyses 0·0128 and 0·0693 per cent. of aluminium.

From these results Messrs. Faraday and Stodart drew the conclusion, that the peculiar excellence of wootz depended chiefly upon the small quantity of aluminium combined or alloyed with the steel,‡ and this opinion appeared to be strongly supported by ingenious synthetical experiments.

On the other hand, Karsten could only detect dubious traces of aluminium in wootz, and Elsner§ attributed the improvement in the quality of the steel produced in Messrs. Faraday and Stodart's experiments, not to the small quantity of the foreign metals, aluminium, silver, platinum, &c.,

* From the London, Edinburgh, and Dublin Philosophical Magazine, July, 1852.
† Quarterly Journal of Science, vol. vii. ‡ Annales de Chimie, tome xv.
§ Journal fur Prakt. Chimie, vol. xx. p. 110.

alloyed with them, but entirely to the operation of remelting, and this seems to be the practical conclusion come to at Sheffield at the present day. The fact, however, of the perfectly damasked surface obtained in the alloys of Messrs. Faraday and Stodart so closely resembling that of wootz, seems to militate against the conclusions of Elsner.

M. Breant attributes the damask of the Eastern blades to the crystallization of two distinct compounds of iron and carbon, and draws a distinction between the oriental damask and that produced by alloys of steel. This opinion is confirmed by the experiments of M. Anocoff, a Russian engineer, published in the *Annuaire du Journal des Mines de Russie*, a few years back. He pretends to have produced blades so nearly emulating those of Damascus, as to allow of their being bent at a right angle, and capable of dividing a film of gauze floating in the atmosphere.*

I obtained from my friend, Mr. Trenham Reeks, of the Government School of Mines, two samples of wootz, furnished to him by Mr. Lewis Humbert, of the military department of the India House; one was in the form of a cake, such as would be produced by allowing the melted steel to cool in the crucible; the other was forged into a small bar, about four inches long and one inch square, and weighed 4760 grs., or rather more than 11 oz. These are the forms in which it is imported into this country. I preferred operating on the bar, for in steel in this form small particles of slag are often so intimately mixed with the metal as to defy separation; and it is possible, as all the alumina found by Dr. Faraday in wootz was in an insoluble form, that it might have existed as silicate of alumina.

The specific gravity of this specimen was 7·727 at 62° F. The composition was:—

	I.	II.
Carbon combined, . .	1·333	1·340
Carbon uncombined, . .	·312	·312
Silicium, . . .	0·045	0·042
Sulphur, ...	0·181	0·170
Arsenic, . . .	0·037	0·036
Iron, ...	98·092	98·100
	100·000	100·000

Cotton as an Element of Industry: its Confined Supply; and its Extending Consumption by Increasing and Improving Agencies. By Mr. Bazley.†

The lecture consisted of two parts, the first of which treated of the progress of the manufacture; the second, of the sources whence the raw material is supplied. The real commencement of the manufacture in England was at the beginning of the eighteenth century, at which period many causes had conspired to render the country fit for the reception of a new source of industry, and from that time to the middle of the century there was great activity in the domestic manufacture of both cotton and

* A specimen of his damask steel is to be seen in the Museum of the Government School of Mines in Jermyn street.

† From the London Athenæum, April, 1852.

sheep's wool. The weavers of those days had frequently to wait for the hand-spun yarn with which they worked, and hence many ingenious men began to direct their attention to the construction of machinery by which the supply might be increased. Thus, Wyatt, in 1730, discovered the principle of elongating fibre by rollers, and was followed by Hargreaves, Arkwright, Kay, Crompton, and others, the inventors of well known machines. The moving power of these machines had hitherto been the animal force of beasts of burden, or wind and water; but these could not be depended on, and it was reserved for steam to supply a prime mover of greater power and regularity than could be obtained from them. Great improvements were taking place during the same time in the methods of communication. In 1720, the waters of the Irwell and Mersey, between Liverpool and Manchester, had been rendered navigable and useful, in the teeth of the opposition of the pack-horse and wagon interest. In 1758 the Duke of Bridgewater engaged Brindley, the greatest Engineer of his day, to construct a canal for conveying the coal of the Worsley estate to the market of Manchester.

The lecturer here gave an interesting sketch of the labors of Brindley, and of the difficulties which had been overcome by the canals, and subsequently by the railways of England. He paid a just tribute to Lancashire, to the energy of which the first successful canal and railway were both owing. So, too, when gas was proposed for illuminating purposes, a Salford cotton spinner was the first to test its advantages on a large scale.

Mr. Bazley next called attention to the increase in the consumption of cotton wool in this country. At the commencement of the last century it was little more than 1,000,000 pounds weight per annum, while the work people employed on it did not exceed 25,000; but at the close of the century 52,000,000 pounds weight per annum were consumed, and the numbers employed were 125,000. Few articles are more generally applied in manufacture than cotton. Its finest qualities are worked into lace and muslin, while from its very waste excellent letter press paper is made. A very extensive trade has sprung up in Bradford, and other places, in "mixed goods," and "union cloths," which are composed of cotton in combination with worsted, silk, or thread. The cotton manufacture has had many variations, and under the restrictive policy it suffered great depressions, but since the alteration in the fiscal system of the country, a beneficial change has taken place, and the race is now free to all. During the past year, no less than 760,000,000 pounds weight of cotton were consumed in this country, passing through the hands of no fewer than 1,250,000 actual workers, or including their families, three millions and a half of our fellow subjects, an eighth of the population of the United Kingdom, while the exports in 1851 amounted to 30,000,000*l.* sterling. Some idea may be gained of the beneficial nature of this industry to the national treasury, from the fact that 12,000,000*l.* sterling, or one-fourth of the whole revenue, is contributed in taxes by those engaged in it, whilst the area occupied by their operatives is not more than one-hundredth part of the surface of the country. In treating the second part of his subject, Mr. Bazley drew attention to the singular fact, that although the British Colonies contain a greater extent of land suited to the growth of cotton than is to be found under any other dominion, yet that the sup-

ply derived from them is less in quantity and far inferior in quality; the supplies in 1851 were, from foreign countries, 1,569,800 bags; from the Colonies, 333,700 bags. And while 16,000,000*l.* were paid for the foreign cotton, only 2,000,000*l.* were realized by the Colonial. Of this large amount from foreign countries the great proportion comes from America; and individuals are now living who recollect the arrival of the first supplies in 1787; the value of the whole crop being now 30,000,-000*l.*, equal to that of the wheat crop of this country. Surely this is a lesson to other countries possessing equally favorable conditions! The lecturer then glanced at the capabilities of the different British Colonies, for producing this material. The West Indian Islands, Port Natal, and our other African possessions were said to be capable of growing cotton quite as well as the United States; while Australia would produce an unlimited amount equal to the very finest. And lastly, there was the great colony of India, where this plant is indigenous, and where it has been known for 3000 years. The evidence of Dr. Royle, the Botanist of the East India Company, that India can yield an abundant supply of good and useful cotton, was quoted as a ground for the presumption that great blame attaches somewhere; since these expectations have never been realized except in a small degree at Guzerat. This part of the subject was closed by the remarkable statement that a piece of ground of the size of Yorkshire is sufficient to produce a quantity of cotton nearly double the annual consumption of England. It is not to be supposed that this trade is on the decline. One factory inspector, Mr. Horner, reports that in his district only, 81 mills have been started during the past year, employing 14,000 hands. Mr. Bazley then examined minutely the probability of the further and future progress of this great industry, and the means to be adopted to insure it: but into this it will be impossible to follow him in a brief abstract like the present. He concluded by an enumeration of the objects of interest, both in the department of machinery and of fabrics connected with the cotton manufacture, at the Great Exhibition; and with an expression of gratitude to his Royal Highness for having become the champion of arts, manufactures, and commerce, and to the Society of Arts for its share in promoting the success of the Exhibition.—*Proc. Soc. Arts, April* 3, 1852.

---

*Iron Flowers.**

A "fancy piece" has been prepared for the Prussian Exhibition by the Renard Works; it is a vase of polished coal, as solid as black marble, holding a large bouquet of flowers made of sheet iron—leaves, petals, and stems, all perfectly graceful and natural, but sable as night. The effect is singular—the complete imitation having not the least resemblance to nature, unless there are such blossoms on the banks of Acheron: it is Flora in mourning.

* From the London Mining Journal, No. 876.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, August 19, 1852.

Frederick Fraley, Esq., President, *Pro. Tem.*

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations were received from Hon. Alexander Evans, Hon. John Robbins, Jr., and Hon. Joseph R. Chandler, Members U. S. Congress; Ellwood Morris, Esq., Civ. Eng., Hillsborough, Ohio; Dr. Ranck, Burlington, Iowa, and Owen Evans, Esq., Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of July.

The Board of Managers and Standing Committees reported their minutes.

New candidates for membership in the Institute (13) were proposed, and the candidates (2) proposed at the last meeting were duly elected.

The following report from the Committee on the School of Design was read, and the resolutions unanimously adopted:

The Committee on the School of Design for Women, have the painful duty to announce to the Institute the death of Mrs. Anne Hill, the Principal of said school. She left the City a few weeks ago to enjoy a short vacation from the labors of the school, and was one of the passengers on board the steamboat *Henry Clay* at the time such a lamentable destruction of life attended the conflagration of that vessel. Mrs. Hill was one of those drowned in an attempt to escape from the boat, and there seems reason to believe that she fell a sacrifice to her efforts to save a drowning child. She had endeared herself to the committee, to the pupils in the school, and to all its contributors and patrons. Of the uniform devotion and energy which she manifested in the welfare and success of the school by her complete adaptions, personal, moral, and professional, for its management, and by those ready and practical talents, which so remarkably contributed to its usefulness, and to the enjoyment of the public confidence. By this sudden and afflictive dispensation of Providence, the school has been bereaved of a head which it will be difficult, if not impossible, to replace. Her children and family have lost a kind, faithful, and religious mother and relative, and the community has been deprived of one whose career of usefulness in a new and philanthropic effort, was full of the promise of rich and abundant good. Sincerely condoling with all of those who have thus lost one endeared to them by the possession of such gifts, the Committee offer the following resolutions:

Resolved, That the sympathy and condolence of the Institute be, and the same are, hereby tendered to the family of Mrs. Anne Hill, to her late pupils, and to her friends, in the great and irreparable bereavement which they have suffered by her death.

Resolved, That a copy of this report and the foregoing resolution, be transmitted to the family of Mrs. Hill, by the President of the Institute, and that the same be entered at large upon the minutes, as an humble tribute of our estimation of her worth and usefulness.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

OCTOBER, 1852.

CIVIL ENGINEERING.

A Report of the Engineer in Chief of the Navy, on the Comparative Value of Anthracite and Bituminous Coals.

OFFICE OF ENGINEER IN CHIEF, U. S. N., *February* 24, 1852.

Commodore JOSEPH SMITH, Chief of Bureau of Yards and Docks.

SIR:—In compliance with your instructions, made in conformity to the orders of the Navy Department in June last, to test the comparative value of Anthracite and Bituminous Coals for the purpose of generating steam, I have the honor to report:

That on the completion of the pumping engine of the dry dock of the New York Navy Yard, I caused experiments to be made with Bituminous (Cumberland) and Anthracite (white ash) Coals; and also on the completion of the United States steamer *Fulton*, in January last, I made a series of experiments with the same varieties of coals; the condensed results of all which are herein given. In addition, I would also state, that the United States steamer *Fulton* has been on constant duty several days since the experiments were made, burning constantly *White Ash Anthracite.*

From a letter from her Chief Engineer, H. Hunt, Esq., detailing her performance for the first four days, I extract the following: "The engine worked as well as any I ever saw, but the boilers exceeded my calculations; with clean fires very *easily* keeping forty pounds, cutting off at half stroke *without blowers.* I will here predict that she (the *Fulton*) will do *more* service at *less expense*, than any steamer government will have in five years. Whilst she was out on the first four days I was in her, we were frequently shut off or cutting off to run slow, and turning around, running from one vessel to another, so no calculations could be made of her speed or slip of wheel. The furnace doors were *open full half the time, to keep steam down*, so much more fuel was used than necessary; but the nature *of our service* was such, that it could not be avoided."

In consequence of the ill health of the Chief Engineer, he was not able to return in her second trip; the results of her consumption of coal on that occasion, are therefore extracted from a letter written by the assistant engineer, S. McElroy, showing the following: "Running time with White Ash Anthracite, January 25 to 28, seventy-one hours. Total coal used, 69,480 pounds, average 992·6 pounds per hour." The above extracts are made, not because they are the most favorable which occur in the log, but as they show the action of the engine and boilers for *several consecutive hours.* Nothing can be smoother than the motion of the engine under ordinary running circumstances; and in relation to the generative power of the boilers, it is more difficult to keep steam *down* than up.

It is unnecessary to use the blowers for ordinary work, as the natural draft proves abundantly sufficient for twenty to twenty-five pounds of steam, with sixteen to eighteen turns; although they are undoubtedly of great value in cases of emergency, and necessary to the prompt and proper management of the fire room, with Anthracite Coal. The *Fulton* will have no difficulty whatever in making twelve knots in ordinary sea weather as long as the bunkers hold out.

A more extended series of experiments would undoubtedly be more favorable to the anthracite, owing to the fact that small quantities were put in the furnaces and almost entirely consumed while the engine was working; it being well known that a small body of bituminous coal will burn longer than the same amount of anthracite spread *thinly* over the grates.

The cost of the two kinds of coals used in the experiments were as follows, at the New York Navy Yard: anthracite $3·90 per ton, bituminous $5·65 per ton.

I have made no comparison of the relative costs of the two kinds of coal, as it may vary according to different localities and periods of delivery, and cannot therefore be considered a fixed element; but have confined the results entirely to their generating powers, deduced from the following experiments:

1. *Experiments with Bituminous Coal, made with the Boilers of the U. S. Steamer Fulton, at the New York Navy Yard, January,* 1852.

The temperature of the water in the boilers being at 38° F., and the temperature of the boiler room 18°, the fires were lighted at ten hours thirty minutes, A. M.

At eleven hours forty minutes, A. M., the temperature of the water was 212° F., and steam began to be generated at the atmospheric pressure. Time raising steam, seventy minutes. The temperature of the boiler room had now increased from 18° to 32° F. At eleven hours fifty-four minutes, A. M., the steam pressure in the boilers was thirty pounds per square inch above the atmosphere. Time of obtaining thirty pounds of steam, one hour and twenty-four minutes, from a temperature of 32° F. Up to this time there had been fed into the furnaces one thousand pounds of dry pine wood, equal to five hundred pounds of coal, and two thousand eight hundred and twenty-six pounds of (Cumberland) *bituminous* coal. Total, three thousand three hundred and twenty-six *pounds.*

The engine was now set in operation to work off all the steam which

above amount of coal would generate, no more being fed to the fur-
es. In fifty-three minutes the steam pressure was reduced from forty
nds to five pounds, and the number of double strokes of piston made
forty-one to seven, when the engine was stopped. During the time
engine was in operation, the steam was cut off at half stroke.

The engine consisted of one cylinder, fifty inches diameter, and ten
four inches stroke. The space between cut-off valve and piston, in-
ding clearance, to be filled with steam per stroke, is 3·094 cubic feet.
calculation of the amount of water evaporated is made from the quan-
s of steam measured out by the cylinder, divided by the relative
ks of steam of the experimental pressures and the water from which it
enerated.

The initial pressure of the steam in the cylinder is taken at one pound
than in the boilers. The space displacement of piston filled with steam,
stroke, is 70·448 cubic feet, to which must be added the above 3·094
ic feet, making a total of 73·542 cubic feet.

Time.	Mean pressure above atmosphere, per square inch in cylinder.	Number of double strokes of piston made.	Cubic feet of water evaporated.
MINUTES.	POUNDS.		
6	32½	41	10·326
5	25	34	7·311
5	22½	32	6·483
5	19¼	31½	5·879
5	16½	31	5·352
5	14	30	4·796
5	11¼	26	3·797
5	9	23	3·075
5	7¼	21	2·631
5	5½	12	1·393
2	4¼	7	0·868
			51·911

Taking the weight of a cubic foot of sea water at 64·3 pounds, the
l weight evaporated is (51·911×64·3)=3337·877 pounds. The boil-
of the *Fulton* contained 82,000 pounds of water at the initial tempe-
re of 32° F., which was raised to 212° F., and 3337·877 pounds of
vaporated by 3326 pounds of coal.

Now it requires five times and a half as much caloric to evaporate a
en bulk of water from a temperature of 212° F., as to raise it to that
perature from 32° F. The quantity of fuel, therefore, expended in
ing the water from the initial temperature to that of 212° F., compared
hat expended in evaporating the 3337·877 pounds from that tempe-
re, will be as (82,000×180°)=14,760,000 to (3337·877×990°)=
04,498·23, or as 4·4666 to 1·000; consequently, $\frac{3326}{4\cdot4666}=744\cdot6$
nds of coal were consumed in evaporating 3337·877 pounds of sea
er, or 4·483 pounds of water per pound of coal. It was intended to
e made, on the following day, an experiment, under precisely the
e circumstances as above, with anthracite; but it was found impossi-
from the presence of *ice* to work the engine; the experiment was there-
only made so far as regards the time of getting up steam, with the
owing *results, viz:*

he fires were lighted with the same *quantity* and kind of wood, and

the same *quantity* of coal that had been used the day previous. At seven hours and twenty minutes, A. M., the temperature of the water in the boiler being 38° F., and that of the boiler room 32° F., with the natural draft, the temperature of the water at eight hours and five minutes was 212°, (steam,) and the boiler room 43° F. Time to generate steam forty-five minutes. At eight hours and twenty minutes, the steam pressure in the boiler was thirty pounds per square inch. Time of obtaining thirty pounds of steam from water at 38° F. was *one* hour.

With the bituminous coal, it will be seen that it required seventy minutes to obtain steam from water at the temperature of 32° F., while it only required forty-five minutes with the anthracite; being a difference of time in this respect of about thirty-six per cent. of the bituminous time.

The data for a comparison of the evaporative values of the coals was obtained by another experiment, as follows:

2. *Experiments with White Ash Anthracite, made with the Boilers of the U. S. Steamer Fulton, in New York Bay, January* 1, 1852.

This experiment was made with the steamer under way, while steaming with steady pressure of steam and revolutions of the wheel, as follows:

Steam pressure (*initial*) in cylinder per square inch above the atmosphere, twenty-five pounds; double strokes of piston per minute, twenty-one and one-third; cutting off at from commencement of stroke, three-eighths; consumption of coal per hour, 1800 pounds.

From the above data, there was filled per stroke 52·837 cubic feet of the space displacement of the piston, to which add 3·094 cubic feet of space comprised between cut-off valve and piston, making a total of 55·931 cubic feet of steam of twenty-five pounds pressure, which would be per minute $55{\cdot}931 \times 42\frac{2}{3} = 2386{\cdot}39$ cubic feet, and per hour 143,183·40 cubic feet. Dividing this last number by the relative bulks of steam of the pressure generated, and the water from which it was generated, we obtain $\frac{143183{\cdot}40}{684} = 209{\cdot}332$ cubic feet of sea water, which at 64·3 pounds per cubic foot, amounts to 13,460·047 pounds, evaporated by 1800 pounds of coal, or 7·478 pounds of sea water per pound of coal.

3. *Experiment with White Ash Anthracite Coal, made with the Boilers of the Pumping Engine at the United States Dry Dock, New York Navy Yard.*

A comparative experiment was made with the boilers of the pumping engine at the New York Navy Yard, in October, 1851, on the comparative advantages of anthracite and bituminous coals. All the conditions were as nearly alike as practicable. With the anthracite coal a combustion of 980 pounds per hour, evaporated a sufficient quantity of water to supply the engine with steam of twelve pounds pressure above the atmosphere, per square inch, for 425 double strokes of piston per hour, the steam pressures being alike in both cases; the economical values of the coals will be represented by the number of double strokes of piston made, divided by the quantity of fuel per given unit of time; or will be anthracite $\frac{425}{980} = 0{\cdot}4337$: bituminous $\frac{294}{1100} = 0{\cdot}2673$, or the anthracite is better than the bituminous in the proportion of $\frac{0{\cdot}4337}{0{\cdot}2673} = 1{\cdot}623$ to $1{\cdot}000$.

It is proper to remark, that these boilers were expressly designed for burning *bituminous coal.*

COMPARISON.

The coals used in these experiments were the kinds furnished by the agents of the government for the use of the United States Navy Yard and steamers, and was taken indiscriminately from the piles in the yard, without assorting.

The bituminous was from the "Cumberland" mines; the anthracite was the kind known as "White Ash Schuylkill."

From the preceding data, it appears that in regard to the rapidity of "getting up" steam, the anthracite exceeds the bituminous thirty-six per cent.

That in economical evaporation per unit of fuel, the anthracite exceeds the bituminous in the proportion of 7·478 to 4·483, or 66·8 per cent.

It will also be perceived, that the result of the third experiment on the boilers of the pumping engine at the New York Dry Dock, which experiment was entirely differently made, and calculated from the first and second experiments, gave an economical superiority to the anthracite over the bituminous of 62·3 per cent.; a remarkably close approximation to the result obtained by the experiments on the *Fulton's* boilers, (66·8 per cent.,) particularly when it is stated that the boilers and grates of the pumping engine were made with a view to burning bituminous coal, which has been used since their completion; while those of the *Fulton* were constructed for the use of anthracite. The general characters of the boilers were similar, both having return drop flues.

Thus it will be seen, from the experiments, that, without allowing for the difference of weight of coal that can be stowed in the same bulk, the engine using anthracite could steam about two-thirds longer than with bituminous.

These are important considerations in favor of anthracite coal for the uses of the Navy; without taking into account the additional amount of anthracite more than bituminous that can be placed on board a vessel in the same bunkers, or the advantages of being free from *smoke*, which in a *war*-steamer may at times be of the utmost importance in concealing the movements of the vessel, and also the almost, if not altogether, entire freedom from spontaneous combustion.

The results of the experiments made last spring on the United States steamer *Vixen* were so favorable, that I recommended to the Bureau of Construction, &c., the use of anthracite for all naval steamers at that time having, or to be thereafter fitted with *iron* boilers; particularly the steamers *Fulton*, *Princeton*, and *Alleghany*, the boilers for all of which were designed with a special view to the use of *anthracite*, and with the approval of that Bureau.

The *Fulton's* bunkers are now filled with anthracite, and the consumptions referred to in the engineer's report on that steamer show, during the short time she has been at sea, that the anticipated *economy* has been fully realized.

In view of the results contained in this report, I would respectfully recommend to the Bureau of Yards and Docks, the use of anthracite in the

several Navy Yards, and especially for the engine of the Dry Dock at the New York Navy Yard.

In conclusion, I desire the approval of the Bureau to make such investigations as my duty will permit, with regard to the *experience* of the durability of *copper* boilers, when used with bituminous or anthracite coal; which can be done without any specific expenditure.

The inquiry may prove highly important to the Navy Department, as the use of anthracite under copper boilers has been heretofore generally considered as more injurious than bituminous coal, and is consequently not used by government in vessels having copper boilers.

Respectfully submitted by your obedient servant,
CHAS. B. STUART, *Eng. in Ch., U. S. N.*

Letter of the Engineer in Chief of the Navy, in relation to Coals, addressed to the Chairman of the Committee on Naval Affairs.

Office Engineer in Chief, U. S. N.,
May 27, 1852.

Sir:—The Senate, by resolution, having called for my reports to the Navy Department, giving the results of several experiments to test the relative value of anthracite and bituminous coals for generating steam, and referred the same to the Committee on Naval Affairs, I have thought that the results obtained from additional tests and experiments, made in this country and England, would be of service to the committee, and trust that the importance of the subject, both to the interests of the government and of individuals, will be considered a sufficient apology, if any be needed, for the liberty I have taken in addressing you this communication.

It should be remembered that what is required to be known on this subject, is neither the absolute nor relative evaporation by coals under conditions that never occur in practice, (as too many experiments are conducted,) but the facts to be determined are, the results which can be obtained from them under the ordinary circumstances in which they are used in marine boilers.

With this view I have prepared the following tabular statement, showing the actual evaporation of water effected by bituminous and anthracite coals in the boilers of several naval steamers, and in those of some transatlantic and river steamers plying to and from New York the past few years.

This table, therefore, from being prepared with care from the steam logs of the different vessels, (those of the navy being on file in this office,) is of great value; more so, undoubtedly, than if the results had been obtained from a series of special experiments made under circumstances not normal to the practice, which results, therefore, must be extensively modified before they could be received for practical guides.

The table includes all the cases I have been able to obtain at this time, where the data were unexceptionable; it extends in most instances over a course of several years steaming, and the average evaporation thus obtained, although not equal sometimes to the maximum of special experiments, is, in my judgment, more entitled to confidence than any single experiment made with greater critical accuracy, but on too small a scale for trustworthy results.

Of the latter character, I should rank those of W. R. Johnson, Esq.

e under the directions of the Navy Department, in 1843, in the Re- of which he states that "on each sample of coal were made from one x trials, according to the quantity furnished. The coal consumed in trial never exceeded 1567 pounds—this being the greatest quantity :h the apparatus could receive in the period allotted to each experi- t, including the time required for cleaning out the residue, making necessary adjustments, and preparing for a new trial. The total ;ht of coal consumed in the trials of evaporative power has been nearly '-two and a half tons; and the weight used, on an average, nine lred pounds per trial"—being less, it will be seen, than half a ton per or not three tons for the greatest number of trials made with any kind of coal, not equal to a two hours' consumption of an ordinary steamer.

hese experiments were not only very limited in their extent, but were e with a boiler entirely different in its construction from those in naval ea steamers, and not at all adapted for that service, and cannot therefore ompared in value to the following practical tests, deduced from the umptions of hundreds of tons of coals on each steamer named and in ıl service.

Table of Practical Tests of Different Varieties of Coal.

es of Vessels.	Trade.	Sea water evaporated from temperature of condenser (100 deg. Fahrenheit) by 1 lb. of bituminous coal.	Sea water evaporated from temperature of condenser (100 deg. Fahrenheit) by 1 lb of anthracite coal.	Remarks.
		pounds.	*pounds.*	
igan,	United States Navy,	*5·000		Fresh water.
ssippi,	do. do.	†4·780		Sea water.
re,	do. do.	†4·870		do.
neer,	do. do.	‡4·531		do.
hany,	do. do.	†5·600		do.
	do. do.	†5·180		Sea water & old flue boil.
eton,	do. do.	†6·666		Sea water and new boil.
eton,	do. do.	§5·372		do. do.
eton,	do. do.		7·554	do. do.
eton,	do. do.		6·639	Sea water and old boilers.
ane,	U. States Treasury,		7·030	Sea water.
	do. do.		6·030	do.
d States,	Transatlantic pack't		7·480	do.
an,	do. do.	†4·467		Sea water and old boilers.
e,	do. do.		8·555	Sea water.
of Pittsburg,	do. do.	†4·930		do.
World,	Hudson River,		8·022	do.
modore,	Long Island Sound,		7·252	do.
oke,	N. York & Norfolk,		6·554	do.
		10)51·416	9)65·116	
	Averages,	5·142	7·235	

rom the averages of the above table, it will be seen that the econo-

* Pittsburg Coal. † Cumberland Coal. ‡ Virginia Coal. § Scotch Coal.

mical evaporation by the anthracite exceeded that by the bituminous in the proportion of 7·235 to 5·142, or about 41 per cent. of the latter.

In the experiments made on coals by Playfair and De la Beche, by order of the British Government, in 1848, I find eleven varieties of Welsh coals having a constitution almost identical with the nine specimens of various Pennsylvania anthracite, experimented on by Johnson, viz:—

	Welsh anthracite.	Pennsylvania anthracite.
Fixed carbon, ...	87·54	88·54
Sulphur, ...	0·79	0·05
Other volatile matter, ...	5·50	5·17
Earthy matter, &c., ...	6·48	6·51
	100·31	100·27

The average evaporation of water by the Welsh anthracite and by the Pennsylvania anthracite was as follows:

Fresh water evaporated from a temperature of 212° F., by one pound of coal.

By Welsh anthracite, ... 9·263 pounds.

By Pennsylvania anthracite, ... 9·590 "

Thus far there is a very close agreement between the results obtained by the different experimenters from substantially the same coal—that coal being anthracite.

In the experiments of Playfair and De la Beche, above cited, I find three varieties of Welsh bituminous, three varieties of Scotch bituminous, and one variety of English bituminous, having a constitution almost identical with the five specimens of Maryland (Cumberland) bituminous coal experimented on by Johnson.

	Welsh, Scotch, and English bituminous	Maryland (Cumberland) bitumin.
Fixed carbon, ...	75·00	75·05
Sulphur, ...	1·47	
Other volatile matter, ...	14·55	15·45
Earthy matters, &c., ...	8·97	9·49
	99·99	99·99

The average evaporation by the Welsh, Scotch, and English bituminous, and by the Cumberland bituminous, was as follows, viz:

Fresh water evaporated from a temperature of 212° F., by one pound of coal.

By Welsh, Scotch, and English bituminous, . . 8·02 pounds.

By Maryland (Cumberland) bituminous, . . . 9·93 "

Here is a great discrepancy between the results obtained by the two experimenters on substantially the same coals; Johnson making the Cumberland bituminous better than the British bituminous in the proportion of no less than twenty-four and a half per cent. of the latter. Had a similar difference been found in the case of anthracite between the results of the two experiments, it might have been accounted for by a difference of boiler or method of conducting the experiments.

From an investigation of the two kinds of boilers employed, I am of opinion that though in their proportions separately different, yet in the aggregate they were equivalent; an opinion justified also by the equality of results obtained with anthracite.

The results, then, of Johnson's experiments are, that Cumberland bituminous exceeds the Pennsylvania anthracite in economical evaporation, four per cent. of the latter; while the results from the English experiments, on substantially the same coals, make the economical evaporation of the anthracite to exceed that of the bituminous over twenty-four per cent. of the latter.

I would here beg leave to remark that there were several important facts attending the experiments of Prof. Johnson, which, rightly understood, would greatly modify his results; and which facts it is absolutely necessary to consider in order to arrive at correct practical information. One of the most important of these is the rapidity of combustion, which is ordinarily measured by the number of pounds of coal consumed per hour per square foot of grate surface, the average quantity of which in marine boilers may safely be taken at fifteen pounds.

In Johnson's experiments, however, the consumption of Cumberland bituminous coal was at the rate of only 7·11 pounds, and of anthracite 6·43 pounds; an average of less than half the practical rate of consumption.

It is obvious, therefore, that the rapidity of combustion being an important element in determining the evaporative efficiency of different coals, that in any experiments made to ascertain this efficiency for marine boilers, the rapidity of combustion should be about the average of what occurs in actual practice at sea.

Again: the importance of the rate of combustion in effecting the results to be obtained from anthracite or bituminous coals, are well signalized in the following extract from a paper by Chief Engineer Isherwood, U. S. Navy, published in *Appleton's Mechanic's Magazine*, for October, 1851, page 621, viz:—

"In the combustion of bituminous coal, *time* is the important element, and a slow rate of combustion with low velocity of draft is necessary for obtaining high evaporative results, and for the following reasons, viz: The bituminous portion of the coal is volatilized and separated from the fixed carbon part at a lower temperature than is required for its ignition, that is, than is required for its chemical union with oxygen. In this gaseous state, occupying the furnaces and flues of the boiler, it can only be ignited by being mixed with atmospheric air at a sufficiently high temperature; the element of time is, therefore, doubly important; first, to allow the gases to become intimately mixed with the atmospheric air; second, to allow them to acquire the necessary high temperature. If now, by means of a powerful draft, the gases, having only the low temperature due to their volatilization, be driven so quickly through the flues and out of the chimney of the boiler as not to allow them time enough to acquire the proper temperature for combustion, and to have the proper mixing with the atmospheric air, a great loss of effect must inevitably follow.

"For the economical combustion, then, of bituminous coal in generating steam, there should be a slow rate of burning, or a small amount consumed per unit of time per unit of surface."

In the combustion of anthracite coal, however, the above general observations do *not* apply. Considering the principal portions of the anthracite to be fixed *carbon, there* will of course be no volatilization of bitumen

at a lower temperature than what is required for the ignition of the fixed carbon; the coal will consequently remain unchanged until the temperature is sufficiently high for its combustion, that is, for the combustion of its fixed carbon; a forced draft cannot, therefore, carry off the fuel before it is ignited, and in this view, velocity of draft is comparatively unimportant. Again, combustion with the anthracite is effected solely by the contact of the air with their solid surfaces; there is therefore no mixing to be done, and consequently no time required to do it in. Here, then, under two important conditions, great velocity of draft, which is highly detrimental to the economical combustion of bituminous, is unimportant in the combustion of anthracite coal."

Taking the above views to be correct, which it is believed they are, it will be perceived that the very *slow* rate of combustion used with the bituminous coal in Johnson's experiments, (a rate utterly out of question with marine boilers,) was in *the highest degree favorable for the development of the full heating power of the bituminous coal;* now as this rate of combustion is impracticable in marine engines, a very great correction for inferior results to be obtained by the faster rate of combustion must be made, in order to obtain their *practical value.* With the anthracite, the very slow rate of combustion used was positively a *disadvantage*, as it could not keep the *whole* mass sufficiently high to enable the fixed carbon to take up the oxygen of the air as fast as the latter entered; consequently it exerted, in a considerable degree, a *cooling* power.

Further, it is generally acknowledged that the quantity of *carbon* in coals is at least an index, if not a full measure of their practical heating power. This idea is entertained by Johnson himself, and is announced in his work on coals, published in 1850, pages 118, 123, and 124, viz:

"The British experimenters continued their analysis of the coals till every sample had been submitted to both proximate and ultimate determination. In the American experiments time was not allowed before the report was demanded, for extending the ultimate analysis to more than one-eighth part of the samples. From such trials as were made, the deductions which appeared to be authorized by a careful comparison between the constituents of the coals and their *evaporative efficiency* was, *that the latter depended upon the total amount of carbon in the coal.* If hydrogen had been, as many European chemists had contended, the more efficient element, weight for weight, then all highly bituminous coals ought to have presented a greater heating power than those of lower bituminousness."

"Both the American and British experiments concur in proving the *reverse of this to be the fact.*"

"This development finally *sets aside the old calculations about the relative heating powers of carbon and of the hydrogen in coals.* By the principle of that calculation, any coal having a high degree of bituminousness ought, in consequence of the large proportion of hydrogen in its bitumen, to possess a much higher heating power than any coal of lower bituminousness. *The reverse of this is true. The higher the bituminousness, or, in other words, the greater the proportion of volatile matter a coal contains, the less is its available heating power.* The fact has been pointed out in former publications of the writer, that when solid hydrogen (that being its state in coals) is converted by the effect of heat into gaseous hydrogen, it

requires for this change a large amount of heat, as experimentally proved in the manufacture of illuminating gas. The hydrogen thus brought to the gaseous state, assumes the same bulk at a given temperature, say 212°, as it will retain at the same temperature when converted into vapor of water under the atmospheric pressure; and consequently, unless we can suppose the capacity for heat of gaseous hydrogen, bulk for bulk, to be greater than that of the vapor of water, we can conceive no reason why it should give out more heat in combining with oxygen than it had taken up in being converted into gas. The British Commissioners refer to this view of the subject, but do not clearly express an opinion of its validity.

"Fortunately, their silence is of less importance, as their own experiments furnish abundant proofs of the correctness of the principle. In order more clearly to exhibit the independence of *hydrogen efficiency* in computing heating powers of analyses, we have placed in the above table the per centage of hydrogen found in each sample of coals. From this column the averages are deduced, and a glance will show, that so far as any law or relation is perceptible, the *coals of highest heating powers are those which have the lowest per centage of hydrogen.*" The table above referred to condensed from Johnson, stands as follows, viz:

	Hydrogen.	Carbon.	Steam by experiment.	Steam by calculation.
	Per cent.	*Per cent.*	*Pounds.*	*Pounds.*
Four coals, average, . .	4·13	74·15	7·78	8·03
Do. do.	4·30	76·63	8·35	8·37
Do. do.	4·57	79·67	8·65	8·60
Do. do.	4·88	81·06	8·89	8·75
Do. do.	4·17	85·68	9·17	9·25
Do. do.	4·55	88·12	9·50	9·51
Do. do.	4·47	88·99	9·75	9·75

"Thus the four coals having a heating power of 7·78, have excess of hydrogen 4·13; the four having heating powers of 9·17, have of oxygen in excess 4·17. It will also be noted that an intermediate class of coals having a heating power of 8·65, has a higher per centage of hydrogen than either of the above, viz: 4·57. This is as we might expect to find it, if the *hydrogen be truly without efficiency in the practical use of coal. Indeed, the hydrogen appears from the practical tests thus far adduced, no more to merit the consideration as an element of evaporative efficiency in coal, than an equal weight of silicia, alumina, oxide of iron, or other inert substance found in its earthly residuum or ash.*"

It appears to be difficult to reconcile the foregoing and well established facts, with the numbers given by Prof. Johnson as the results of his experiments on anthracite and Cumberland (bituminous) coals, the former containing 88·54 per centum of carbon, and the latter only 75·05 per centum, while he makes the latter *four per centum* better than the former, while it should have been as above demonstrated, the reverse in the proportion of 88·54 to 75·05, or eighteen per centum.

The results of the British improvements on substantially the same coals,

viz: containing relatively 87·54 and 75 per centum of carbon, gave for the former a greater efficiency of twenty-four and a half per centum, making a difference in the results of over twenty-eight per centum.

A large number of experiments and practical tests might be cited to further prove the greater efficiency of anthracite over bituminous coals, in proportion very nearly as the element of carbon was found; but they would swell this paper, now already too extended. I have therefore confined the comparison to a few experiments of admitted correctness, to illustrate the facts, and in conclusion would add, that I agree fully with the views expressed in Professor Johnson's report, "that for the purpose of steam navigation, therefore, the rank most important to be considered (in different coals) is in the order of their evaporative power under given bulks. This is obviously true, since, if other things be equal, the length of a voyage must depend on the amount of evaporative power effected by the fuel which can be stowed in the bunkers of a steamer, always of limited capacity. With this scale of value, however, must be combined the relative freedom from clinker, and the maximum rapidity of action; while the rapidity of ignition is of inferior importance, but may deserve some consideration where short voyages, frequent stoppages, and prompt commencement of action are demanded." All of which qualities I think have been from practical results found to be more fully combined in the white ash anthracite of Pennsylvania than any other known coal. I therefore fully concur in the opinion of Professor Johnson, expressed in his work on coals, published in 1850, page 160:

"In conclusion I may observe, that while these analyses demonstrate the high density and compactness of this coal, (anthracite,) fitting it for the purposes of steam navigation, for which these qualities, combined with great heating power, are of primary importance, they also show, that for the various arts and for domestic consumption, its properties are calculated to sustain the high character of the central coal-field of Pennsylvania, for the concentrated and durable heat which it furnishes, and the absence of those ingredients which might interfere with its useful application."

I have the honor to be, sir, with great respect, your obedient servant,

CHARLES B. STUART, *Eng. in Ch., U. S. N.*

---

*Law Expenses of Railways in Great Britain.**

The Court of Common Pleas was asked the other day to grant a rule calling on the Master to review his taxation of plaintiff's attorney's bill, in the case of Edwards and another, assignees of Parker, *v.* the Great Western Railway Company. The Court appears to have been much moved at the application.

In that bill a little item (among others) of £1300 occurred as the charge for the "notice of action." It seems the Master had knocked off £1000 of it, leaving the odd £300 to be charged. Now £300 seems to our sim-

* From Herapath's Journal, No. 678.

e mind pretty fair for the mere preliminary step of a "*notice* of action." 'hen all the gold from California and Australia comes, perhaps we ight be more liberal in our notions; but as long as gold remains as dear ; it is, we fear we shall never think of a "notice of action" costing 300 without shuddering; and yet the £300 is less than a fourth of the m charged. The Chief Justice was, however, as illiberal in his remarks ; we are, for he said that even "the allowance made by the Master £300) was overmuch."

This notice of action had taken *three years to prepare;* had occupied no ss than *ten clerks;* consisted of *forty-one folio volumes;* and the time »nsumed in work upon it was 6666 *hours!!!*

Before the "notice of action" came to light, we thought the most won- ›rful thing in the railway world was an act of incorporation for one com- ıny costing £600,000. But the "notice of action" completely takes the shine out" of that.

We trust the 41 folio volumes of the "notice of action" will be care- ılly preserved. The Great Western Railway Company, the unfortunate arty on whom the "notice" was served, should have them handsomely ound, and on the back of each have it labelled in gilt letters—"Notice ſ Action by one of the carriers on the line." We do not know whether ıe Great Western Company have any book-case large enough to contain l the folio volumes; if not, we think we know a party who would be ery glad to provide, *gratis*, a place for them—the Great Exhibition ompany. Mr. Russell could not confer on a brother railway Chairman greater boon than to allow Mr. Laing the loan of these volumes of no- ce of action, for public exhibition in his Crystal Palace. We are confi- ent it would draw a vast concourse of sight-seers to Sydenham.

Mr. Russell cannot be expected to give outright the notice of action to is railway friend. It has, at the much reduced price, cost the Great Vestern an enormous sum—£300, or more than £7 a volume; the origi- al, but disallowed charge, having been £1300, or about £30 a volume. : is true, that costly as this library is, the intrinsic value of it is just about s much as the purchaser of waste paper would give for it.

> "The proper price of a thing
> Is just as much as it will bring."

Although "the notice of action" might be nothing but waste paper in ıtrinsic value, yet, if it will "show" and attract a great many to the new 'rystal Palace, it has a value which it is difficult to estimate. Therefore, ıe Great Western may not have been forced into an expenditure so un- ›roductive as at first sight appears. On the contrary, if Mr. Laing's Crys- ıl Palace Company be favored with the loan of it, the Great Western ught to be paid at least good interest upon the outlay; and if Mr. Laing hould not have it, then possibly a show room at the Paddington station ould be fitted up, and derive to the Great Western Company a large ıcome at the small charge of only a penny a peep. Scarcely a passenger n the crowded Great Western Station would object to give a penny to ee what the 41 volume "notice of action" was like.

*Lackerstein's Patent Carbonic Acid Gas Engine.**

Mr. J. F. Lackerstein has patented some improvements in obtaining motive power, which consist of certain combinations of means and apparatus for obtaining power by the use of carbonic acid gas. The apparatus employed for generating the gas, and bringing it to a fit condition for use in the engine, consists of three vessels—a generator, a purifier, and an expander. These vessels are each of a cylindrical form, with hemispherical ends, and are connected with each other by suitable arrangements of pumps and pipes. The materials from which the gas is obtained (and which the patentee prefers to be sulphuric acid and carbonate of soda in solution, or other equivalent materials yielding residuary products of commercial value,) are pumped in atomic proportions into the generator, and caused to combine intimately by traversing a percolator filled with broken glass or other such materials, whereby an extended surface is obtained. After passing through the percolator, the used materials are collected at the bottom of the vessel, and discharged from time to time by means of a self-acting float valve, which rises from its seat when the liquid has attained a certain level, and falls again and closes the exit orifice when, by the discharge of part of the liquid, the level of the liquid in the generator is reduced. In order to prevent the float being crushed by the pressure of the gas, it is perforated at the top, whereby gas is admitted, and the interior filled at the same pressure as exists in the generator. The falling liquid from the percolator is prevented from entering the float by a shield, which serves to disperse it, and keeps it from contact with the open part of the float. The gas produced in the generator is pumped into the purifier, where it is passed through water, and from which is supplied to the expander by a double plunger pump of a peculiar construction. The expander is surrounded by a jacket in which steam, hot air, or hot water is caused to circulate, and the pressure of the gas is thereby much increased, or the use of a current of electricity may be adopted for the same purpose. From the expander the gas passes to the cylinder of the engine, where it actuates a piston in precisely the same manner as steam is caused to act on the piston of a steam engine. After performing its duty in the cylinder, the carbonic acid is passed through a vessel, containing in solution some chemical substance, capable of combining with it to form a material, which on being concentrated or evaporated to dryness, may be again used in the production of carbonic acid gas. Those portions of the apparatus which are liable to be corroded by the acid employed, are to be protected by a covering of gold or platina, or to be formed of those metals. With the same view, the interior of the generator is lined with sheet lead. Although sulphuric acid and carbonate of soda are the substances which the patentee prefers to use for producing gas for the purposes of his invention, he does not confine himself thereto, but uses bi-carbonates and sesqui-carbonates of soda, and carbonates of other alkalies and other acids than sulphuric, as also substances with an acid reaction; the object which he has in view being to obtain at the same time with the production of gas residuary

* From the London Mining Journal, No. 877.

materials of commercial value. Thus, from sulphuric acid, and carbonates of soda, potash, or ammonia, are obtained residual sulphates of those bases; from nitric acid with the same bases, valuable nitrates; from boracic acid and soda, the borax of commerce; from alum, with potash or soda, valuable fertilizing salts; from chromic acid and potash, chromate of potash, a compound valuable in dyeing; and from hydrochloric acid and ammonia, sal-ammoniac of commerce. These, however, are merely given as examples.

Claims.—1, The employment of the specified materials when corrosive acids are used, in the construction of the pumps and other parts of the apparatus. 2, The use of a percolator, whereby the materials forming the gas are more intimately mixed together by passing through a more extended surface. 3, The self-acting float valve, whereby the residuary matters collected at the bottom of the generator are discharged from time to time. 4, The purifier, whereby the carbonic acid gas is purified before being used, to prevent any injurious effect on the engine. 5, The pumping the gas into the expander, to increase its pressure by the action of heat previous to its being used in the engine, whereby greater economy is obtained in the consumption of the gas. 6, The heating and expanding of the gas for the last mentioned purpose by means of electricity. 7, The construction of a double plunger pump, which, requiring no valve, is particularly adapted for all aëriform and gaseous fluids, which require to be compressed or condensed under strong pressure, the mechanical arrangements of which are above described.

---

*Trial of Parsey's Compressed Air Locomotive.**

Mr. Parsey having completed an engine on his principle, a successful trial took place on the Eastern Counties Railway on Tuesday last. Being the first experiment, to avoid accident, and by particular request, the compressed air was worked at a low density. The small engine, adapted to the narrow gauge, started from the Stratford station, and on reaching Lea-bridge was reversed, and came back to the Stratford station, a distance of four miles. Mr. Parsey drove her himself, assisted by his son, and was accompanied on the engine by Mr. Trevethick, Mr. Ashcroft, and another officer of the company, Mr. Box, proprietor, and two others, in all eight persons. A pilot engine, with persons connected with the railway, followed the compressed air engine, to witness the trip. The effect of an engine running on the rail without heat or steam was extremely novel and imposing.

Sir:—I am unable to give the result of further experiments to that which took place on the 25th of May, as certain arrangements for that purpose have caused an unexpected delay. In the meantime, valuable data afforded by the first trial may not be unacceptable to your readers and the proprietors of railways.

The capacity of the reservoirs is 39 cubic feet, and were charged up to 11 atmospheres = 165 lbs. per square inch. The regulator of the piston

* From the London Mining Journal, No. 875–877.

was set at starting at 20 lbs. As the engine with this limited charge of air and working pressure took 1760 revolutions of the 4-feet driving wheels in running four miles, the capacity of the cylinders being 180 cubic inches=4 cylindersful each revolution, would use 183 feet of air at some density; and as we had 429 cubic feet of atmospheric air only in the reservoirs, 183÷429, gives 2·3, or less than 1¼ atmospheres for the density of the 183 feet blown off, or about 18 lbs. per inch on the pistons. On the average, the working pressure could never have exceeded 18 lbs., as there was some power remaining on her return. The pistons being 2·5 diameter, equal to 5 inches in area, with less than 20 lbs., drove the engine and eight persons on it (2 tons besides the wheels) at the rate of eight miles per hour with the brake on, heavily pressed upon by the superincumbence of the eight persons pressing down the light springs, and crushing the brake upon the wheel, fixed on the centre of the crank shaft. This had been adjusted while the engine was free of the weight of the passengers. The consequence was an oversight, which, however, proved the power to be equal to the obstacle to starting and a fair speed.

As 400 cubic feet of atmospheric air drove the engine, &c., 4 miles, it is evident 100 feet drove her 1 mile. Now, as nothing could be said against my engine, it has been industriously circulated (before the experiment took place) that the cost of power would be prejudicial to the use of air engines. There is evidence existing that the Portable Gas Company compressed 1000 cubic feet per hour with a 10 horse power engine. It is well known that 3 lbs. of coal per horse power per hour is the outside expense of working stationary engines; consequently, as 30 lbs. compresses 1000 cubic feet, 1 ton or 2240 lbs. would compress 74,666 cubic feet of air, costing 8s. or 10s. at most; and as 100 feet drove the experimental engine 1 mile, that quantity would drive her and a carriage 746 miles for that cost.

A. Parsey.

Oxford street, June 10.

---

*Speed and Fares on the Great Western, and London and North Western Railways.**

It appears from a comparison of the speed and fares of the express trains upon these railways, that the speed of the fastest trains between London and Bristol on the Great Western is 43 miles per hour, and on the London and North Western, between London and Birmingham, 40 miles per hour; the difference in favor of the former company being 3 miles per hour. The speed of all the mixed trains between London and Plymouth, and London and Liverpool, is 35½ miles per hour on the Great Western, and 36½ miles on the London and North Western—being 1 mile per hour in favor of the latter. The average fares per mile on the Great Western are—for first class, 3·068*d.*, and for second class, 2·502*d.*; while on the London and North Western the average is, for first class, 2·676*d.*, and for second class, 2·178*d.*; showing a difference in favor of a passenger traveling by the London and North Western Railway of

* From the London Civil Engineer and Architect's Journal, July, 1852.

0·392*d*. for first class, and 0·324*d*. for second class. A comparison of the time occupied and fare charged on a journey of 246¾ miles on both lines, shows a difference in time in favor of the London and North Western of 34 minutes by a first class train, and of 12 minutes by a mixed train; and also at the same time a saving of 8*s*. 1*d*. for that distance by the first class, and of 6*s*. 8*d*. by the second class; the fares on the Great Western Railway for first class being 63*s*., and for second class 50*s*. 6*d*.; while on the London and North Western the fare for the first class is 54*s*. 11*d*., and for the second class 43*s*. 10*d*. By the mail trains, the average speed per hour is 25 miles on the Great Western, and 28 miles per hour on the London and North Western; the difference in favor of the latter being 3 miles per hour. The average fares per mile on the former railway amount to 2·724*d*. for first class, and 1·867*d*. for second class; while on the latter railway they amount to 2·419*d*. for first class, and 1·775*d*. for second class; showing a difference in favor of the latter of 0·315*d*. for first class, and 0·092*d*. for second class. A comparison of the time and fares calculated on a journey of 246¾ miles, shows a saving in favor of the London and North Western of 58 minutes, and of 6*s*. 3*d*. in first class fares, and 1*s*. 10*d*. in second class fares. By the ordinary trains, the average speed per hour on the Great Western is 25 miles, and on the London and North Western 26¼ miles, being 1¼ mile in favor of the latter. The saving in the first class fares being 0·583*d*., and in second class fares 0·291*d*. per mile also in favor of the latter company. A comparison of the time occupied on a journey of 246¾ miles, shows a difference in favor of the London and North Western of 21 minutes, the time occupied by the Great Western trains being 9h. 53m.; by the London and North Western, 9h. 32m. The saving in the first class fares is 12*s*. 4*d*., and in the second class fares, 6*s*. 1*d*. in favor of the latter company.

For the Journal of the Franklin Institute.

Remarks on Incrustation in the Boilers of the Steamship Isabel.

A few weeks since, the steamship *Isabel* came into this port for repairs of hull and machinery, and to replace her boilers. The boilers have been removed, and are now being cut up; an opportunity has thus been afforded to obtain the accompanying specimens of scale from her boilers, which in the opinion of the writer, show an extraordinary degree of ignorance or negligence on the part of those persons having charge of her machinery.

If we are not mistaken, this vessel commenced her service in the winter of 1848, and the boilers have therefore been in use three and a half years; the ship plying semi-monthly between Charleston, Havana, and Key West. She is under steam an average of sixteen days per month, for ten months in each year; consequently, the boilers are now to be replaced, after about 600 days' service. The vessel being laid up for two months in each year, for a general overhaul and repair, it is to be supposed that *at such times at least* the scale is removed; in fact, the number of laminæ in one of the pieces forwarded agrees with this supposition; therefore, this accumulation, estimated to amount to about a ton, has

been deposited in less than a year. It is commonly asserted, to exculpate careless engineers, that the water in the vicinity of coral reefs holds in suspension, in addition to the usual constituents of sea water, a quantity of carbonate and sulphate of lime. I am not aware that this assertion has been proved by an analysis of those waters; but an experience of four years on board steamships in the Gulf of Mexico, satisfies me that no accumulation of scale to exceed one-sixteenth of an inch need be made.

These boilers have common return flues, and there could have been no difficulty in cleaning them, if inadvertently in a careless moment a small deposition had been made; but unfortunately, many engineers confine their attention to the interior of the furnaces and flues, to the neglect of the interior of the boiler.

The scale averaged three-eighths of an inch thick over the shell, and upwards of half an inch on the flues and connexions; in some places not less than four inches thick; the greatest deposit in the vicinity of the back connexions, where it hung pendant like stalactites.

There can be, I think, no doubt but that this extraordinary accumulation was caused by neglecting to blow, and carrying the water at a density approaching saturation. The loss occasioned by this neglect, independent of that caused by the short term of duration of the boilers, cannot be estimated at less than fifty per cent. in fuel; and we can only attribute their exemption from collapse to the thorough manner in which they are braced, and to the fact that the engines were short of steam, and worked it off with such rapidity as to keep the pressure below the point necessary to collapse red hot flues.

Specimen No. 1. Taken from over the furnace; iron in contact with it much injured, and showing evident marks of having been overheated; half an inch in thickness.

No. 2. Taken from an angle of the furnace, at the entrance of the flues; this specimen is completely vitrified; five-eighths thick.

No. 3. Taken from the vertical portion of the shell, adjacent to the furnace; this specimen has not been in contact with red hot iron, and presents an entirely different fracture and appearance; five-eighths in thickness.

No. 4. Taken off a flue at the back connexions; presents a crystalline fracture, and marks of having been subjected to great heat; one inch and a quarter in thickness.

Note.—The specimens sent by our correspondent, are as usual, sulphate of lime, for the most part crystalized. We do not know that waters from the vicinity of coral reefs have been analyzed, but we have published in our Journal, (Vol. xiv, p. 297, 3d Series, for instance,) accounts of the formation of scale in the boilers of steamers navigating those waters, which show a very great amount of the sulphate of lime in such waters. It would seem that the scale will form very rapidly, and in fact, theory will indicate the same thing, on account of the insolubility of sulphate of lime in hot water. Blowing at short intervals of time appears to be unavailable to prevent the formation of scale, but certainly these facts will not justify the formation of stalactites. Every one who sees the specimens now sent, will at once admit that they indicate very gross negligence on the part of those in charge. Editor.

AMERICAN PATENTS.

List of American Patents which issued from Aug. 10th to Sept. 7th, 1852, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

15. For an *Improvement in Processes for Making Illuminating Gas;* Henry W. Adams, City of New York, August 10.

Claim.—"What I claim as my invention is, the process of manufacturing illuminating gas, substantially as herein set forth, the process of feeding into heated retorts charged with bituminous coal, either oil, coal tar, resin, or asphaltum, or any other bituminous or carbonaceous substances, separately or mixed, and reduced to a fluid state, and decomposing the same in the same retort, and by the use of the same heat, in conjunction with the distillation of the coal, in the manner and for the purposes substantially as herein described."

16. For *Improvements in Double Gates;* J. S. Brown, Washington, D. C., August 10.

Claim.—"What I claim as my invention is, the arrangement of the forked rods, or their equivalents, in combination with the inclined track and roller, for the purpose of causing the gate always to swing in the direction from the rider. substantially as herein set forth.

"I also claim the combination of the latch, catch, and pin, or their equivalents, substantially in the manner and for the purpose herein set forth."

17. For an *Improvement in Casting Type;* William P. Barr, Assignor to George Bruce, City of New York, August 10.

Claim.—"What I claim as my invention is, the employment in type casting machines of an adjustable valve, substantially in the manner described."

18. For an *Improvement in Cider Mills;* Jarvis Case, Selma, Ohio, August 10.

Claim.—"Having fully described the nature and operation of my invention, what I claim as new is, the employment of the revolving crushing cylinder or roller, with grooves cut in its periphery, the movable feeding slats or radial cogs, the eccentric rings or plates, and the scrapers, the whole being constructed, arranged, and operating in the manner substantially as and for the purpose herein set forth."

19. For an *Improvement in Machines for Drilling Stones;* Henry W. Catlin, Administrator of the Estate of Alexander Catlin, deceased, Burlington, Vermont, August 10.

"This machine is intended for boring or drilling stone, by the rotation of a wheel or radial arms, furnished with revolving cutters, which grind or pulverize the stone with which they are placed in contact."

Claim.—"In behalf of the within named Alexander Catlin, I claim the revolving arms or wheel, having a cavity near its centre, to receive the core of the stone, in combination with the revolving cutters, in the manner and for the purpose herein described."

20. For an *Improvement in the Method of Securing Movable Points of Railroad Frogs;* Marshall Curtis and Edgar St. John, Binghampton, New York, August 10.

Claim.—"What we claim as new in our invention is, the combination of the peculiarly formed shank of the frog point and its corresponding channel and socket; said point secured to its seat by spike and bolts, or their equivalents, substantially as described."

21. For an *Improvement in Tanning;* A. K. Eaton, Rochester, New York, August 10.

"My invention consists of a combination, with my tanning liquor, of certain substances which have the effect of facilitating its action; also of preventing the extraction or other matter of the bark or substance from which the tannin is obtained, from acting injuriously upon the leather."

Claim.—"Having thus described my process of tanning leather, what I claim as my invention is, the combination of sulphate of potash with the tanning liquor, substantially in the manner and for the purposes herein set forth."

22. For an *Improvement in Grain and Grass Harvesters;* Daniel Fitzgerald and John H. Smith, City of New York, August 10.

"The nature of this invention is the adaptation of the common grain cradle to machinery. The apparatus consists of a cart, (the two wheels of which are the motors of the machinery,) and the cradling apparatus attached."

Claim.—"What we claim as our invention is, 1st, The construction of the floor in the centre, upon which a man may stand to gather the grain.

"2d, The construction the rim, to which the knives are attached, for the purpose of giving the buts of the grain a bed to stand upon, while being carried through the channel to the centre.

"3d, The constructing a spiral channel within the guards, for the purpose of gathering the grain within the central space."

23. For an *Improvement in Carriages;* Jonathan Fox, Manchester, New Jersey, August 10.

Claim.—"What I claim as my invention is, 1st, Making the hubs of wheels of two disks of wood, with angular scores cut in them, to which the spokes are fitted, so that as the disks are drawn together, they bind the sides as well as the edges of the spokes; said disks of wood being fitted to and confined between two plates of metal, substantially as described.

"2d, The sliding perch, in combination with the levers, ratchet wheel, and pawls, or such analogous devices equivalent to these as will raise the hind end of the body of the carriage and load, when the hind axle stops, while the fore one moves forward; the weight of the hind end of the body and load aiding, as it descends, in propelling the hind axle forward; the body being made to slide upon the rocker of the forward axle as described, or otherwise.

"3d, The sliding perch, in combination with the levers, or such analogous devices equivalent thereto as will raise the load, or a part of it, when the team or moving power starts, so as to partially relieve the team and carriage from the sudden jerk and shock to which it is subject when the connexion is firm and unyielding."

24. For an *Improvement in the Manufacture of Glass Lenses;* John L. Gilliland, City of New York, August 10.

Claim.—"What I claim as my invention is, the manufacture of dioptric lenses of glass in steps or rings, by pressure in metallic moulds, substantially as specified."

25. For an *Improvement in Method of Converting Reciprocating into Rotary Motion;* Charles Howard, Alton, Illinois, August 10.

Claim.—"What I claim as my invention is, an apparatus, substantially such as is herein described, for converting a reciprocating motion into a rotary one, or converting a rotary into a reciprocating motion, consisting of the wheel, levers, and connecting rods, or their equivalents, for the purposes specified."

26. For an *Improvement in Mode of Drying Sized Paper;* John Kingsland, Jr., Saugerties, New York, and Norman White, City of New York, August 10.

Claim.—"Having fully described our invention, what we claim therein as new is, the process of drying sized paper, by passing it between a series of trunks, perforated on two sides, and so arranged, that the hot air passing through these perforations will come in contact with both sides of the paper, and then escape, and not run or be confined with the sheets."

27. For an *Improvement in Reducing Gold Mineral;* William Longmaid, Beaumont Square, England, August 10, 1852; patented in England, January 29, 1852.

Claim.—"I do not claim the use of lime when forming fluxes; but what I claim is, the use of iron, substantially as described, to extract portions of gold, when the same are not readily precipitated by their density."

28. For an *Improvement in Looms for Weaving Pile Fabrics;* Samuel Richardson, Claremont, New Hampshire, August 10.

"These improvements relate chiefly to the peculiar construction and to the mode of operating the pincers, which draw out and insert the wires which are placed between the ground and pile warps, for the purpose of raising the loops which form the pile."

Claim.—"What I claim as my invention is, the spring flaps, or their equivalents, which open and close the pincers upon the wires, and support the wires after they are drawn

from the loops and carried to a proper position, to be inserted between the sheds of warp and guiding them into the same, substantially as described."

29. For an *Improvement in Railroad Car Brakes;* John Schoenherr, Reading, Pennsylvania, August 10.

Claim.—"Having fully described and represented the nature and operation of my improved mode of rendering railroad car brakes inoperative at the pleasure of the engineer, or man in the locomotive tender, and thus dispensing with a corps of brakemen, what I claim therein as new is, the method of arranging and operating the parts which render the brakes inoperative, at the pleasure of the engineer or other hand, viz: hanging the drops, *a*, from arms, *v*, on arbors, *t*, with arms, *s*, projecting in a contrary direction to the arms, *v*, the arms, *s*, being connected by links, *q* and *r*, midway to a lever, *k*, the end, *l*, of which is the fulcrum; the power being applied to the other end, through the eye, *m*, by means of the rope, *n*, which passes through loops, *o*, along the entire train, to the rear end of which it is made fast; the same devices being repeated, and capable of instantaneous action on each car; the arrangement thus having nothing in itself antagonistic to the end in view, the rope, *n*, being always slack, and by its own weight and motion, when the train is under way, keeping the drops, *a*, up and out of the way of the brakes, so that the brakes are always operative, unless the engineer, by winding up the rope, *n*, throws down the drops, *a*, and renders the brakes inoperative for the time being; the whole being substantially as described and represented: by no means intending to claim, however, the interruption of the operation of the brakes, actuated by the crowding of the cars upon the locomotive, by the interposition of drops, when these are interposed by mechanism, the weight and motion of which, when the train is under way, is antagonistic to the counterbalance intended to keep the drops up and out of the way of the brakes."

30. For an *Improvement in Hats;* Benjamin Sherwood, County of New York, August 10.

Claim.—"What I claim as my invention is, 1st, The attaching to a hat a ring, or part or parts of a ring, inside, to fit upon the head, and leave a space around it, for the purpose of producing ventilation, in the manner substantially as described.

"Second, I claim constructing a band, for the purpose of fitting easily to the head, of thin metal, made flexible by cutting out part of the substance, in the manner substantially as above described in the strip, fig. 4."

31. For *Machinery for Threading Wood Screws;* Cullen Whipple, Providence, Rhode Island, August 10.

"My invention and improvement consists of a rotating concave annular burr cutter, for threading screw blanks, and of a combination of the foregoing with suitable rests and turn screws, for presenting the blank to the cutter, and rotating it while being threaded; likewise, of a combination of a vibrating rest to support the screw blank, and a rotating turn screw vibrating with the rest, to turn the blank."

Claim.—"What I claim as my invention is, 1st, An annular concave burr cutter for threading screws, having a helical or conical serrated thread, substantially as described.

"2d, The combination of the moving rests on opposite sides of a revolving screw cutter, with the mechanism herein described, or the equivalent thereof, for operating the same in such manner as to move them simultaneously towards and from the cutter, to press the blanks against the latter to be threaded, and so that the pressure of one blank in one direction may be counteracted by the pressure of another blank in the opposite direction, as set forth.

"3d, The combination of the vibrating rests with the vibrating rotating turn screws, substantially in the manner herein described, so that the blank may be rotated steadily and with regularity, while the rest is carrying it towards the cutter, to sink a screw thread on it."

32. For an *Improvement in Mill Dress;* John W. Kane, New Carlisle, Ohio, August 10.

Claim.—"I do not claim a circular mill-stone dress, in which the furrows are arcs of circles swept from a single centre; but what I do claim is, the particular mill dress represented in fig. 1, and laid down by the pattern shown in fig. 2, constructed and arranged as described, or in any manner substantially the same."

33. For an *Improvement in Ventilators;* Mortimer M. Camp, New Haven, Connecticut, August 17.

Claim.—"I do not claim the upper cylinder, the flanches attached thereto, the lower

cylinder, nor either set of the wings upon a vertical shaft therein; but what I do claim as new is, the two cones arranged and combined with a ventilator, composed of revolving vanes and flanches and cylinders, operating as above described and set forth."

34. For *Improvements in File Cutting Machinery;* John W. Conklin, Henry L. Sidman, and Eugene Wintner, Ramapo, New York, August 17.

Claim.—"Having described our improvements in machinery for cutting files, what we claim as our invention is, as herein constructed and combined, the racks, pinions, cams, or eccentrics, rods, and springs, in connexion with the vibrating hammer, as described, for the graduation of the blow, at the commencement of the operation."

35. For a *Machine for Making Wrought Iron Railroad Chairs;* Robert Griffiths, Newport, Kentucky, August 17.

"The nature of my invention consists, 1st, in a combination of devices, whereby my machine is rendered capable of adjustment, for cutting and turning the clips of a wrought iron railroad chair, of varied forms and of any required size, to fit the various sizes and patterns of rails in use.

"2d, In so forming and operating the cutting edges, that they shall shear the plate in such lines, that when cut, it shall be perfectly free from the dies, and not remain in contact with them, to draw the temper, and render them incapable of making a smooth cut, as is the case with other machines heretofore used for this purpose."

Claim.—"Having thus described my invention, what I claim therein as new is, 1st, the arrangement and combination of the feathered wedge and dies, as described, for filling the cavity between and fitting around the knuckle end of the shears and benders, forming an adjustable, solid, and level bed for the centre of the plate, whilst being cut and bent, and preventing the fulcra of the shears and benders from moving towards the centre, away from the set screws.

"Secondly, I claim furnishing the caps of the pedestals with adjustable cutters, the cutting edges of which are nearer to each other at the outer than at the inner end, and which shear the plate, in conjunction with the cutters on the face of the shears, which are narrower at their outer than their inner end, in order to cut the clip of the chair narrowest at the point, and thereby leave it perfectly free and clear of the cutters in the cap, so that the cap will lift free from the plate."

36. For *Improvements in Spark Arresters;* Joseph Leeds, George H. Oat, Jr., and Alfred A. Oat, Assignors to Joseph Leeds, Philadelphia, Pennsylvania, August 17.

"The nature of our invention consists in surrounding the spark chamber, or that part which usually constitutes the outside of the stack, with a draft flue, which has openings below, flared or otherwise, to take in the air, and which extends up above the top of the inner chimney, and may be covered by a cap, or otherwise; said draft flue being for the purpose of aiding the draft of the chimney, which becomes impeded by the separation of the sparks from the other products of combustion."

Claim.—"Having thus fully described our invention, what we claim therein as new is, combining with a stack or chimney, provided with chambers and openings for separating and passing out the smoke and gases, and retaining the sparks, substantially such as herein described, the draft flue around the stack which takes in air at the bottom, and furnishes at the top of the chimney additional draft to supply that impeded by the separation of the sparks; the whole being arranged substantially as herein set forth."

37. For an *Improvement in Cotton Presses;* Lewis Lewis, Vicksburg, Mississippi, August 17.

Claim.—"Having fully described the nature and operation of my press, what I claim therein as of my invention is, the arrangement of the press herein above described, in such manner that it may be conveniently charged in an upper story of the building in which it is placed, and actuated and discharged in a lower story of the same, substantially as herein set forth, reference being had in my claims for Letters Patent, to the drawings and specifications as filed and herein before set forth."

38. For an *Improvement in Hernia Truss;* Allen I. Lownsberry, Sommerville, Tennessee, August 17.

"The principal feature of this invention, and upon which its utility and excellence mainly depend, consists in the peculiar form of the front plate, or pubic brace, and its combination, as a strong support to the bowels and abdomen, with the curative action of

he balls upon the track of the inguinal canal, and its peculiar connexion with the other parts of the apparatus."

Claim.—"What I claim as my invention is, the peculiar shape of the two balls, and heir arrangement upon the slides, so that they may be moved upward and downward, and ight and left, to any part of the metallic plate on the pubic brace, and thus be fitted to ny rupture in the abdominal rings, or on any sized person, and their combination with he pubic brace, as above described."

39. For an *Improvement in Artificial Legs;* B. Frank. Palmer, Philadelphia, Pennsylvania, August 17.

Claim.—"I am aware that the tendo achilles has been extended upward and attached o the thigh piece, for the purpose of drawing upward the heel, and depressing the forward art of the foot, when the leg is straightened; and therefore I do not claim that arrangement as my invention. But what I do claim as new is, attaching the upper end of the endo achilles to a lever, or to its equivalent mover, which is united to an auxiliary tendon, hat descends from its connexion with the thigh piece; and also the so arranging of the aid lever and tendons that when the weight of the person is thrown upon the ball of the foot, in walking, the powerful downward strain, which will thereby be exerted upon the tendo achilles, will exert little or no influence upon the said auxiliary tendon, (which descends from the thigh piece,) or at any rate, no influence that will have an appreciable tendency to bend the knee, or give instability thereto, substantially as herein set forth."

"I also claim the vibrating brace and elastic cord, operating in combination, substantially n the manner and for the purposes herein set forth."

40. For an *Improvement in the Neck Yoke of Horses;* Calvin L. Rawdon, Bristol, Ohio, August 17.

Claim.—"What I claim as my improvement is, the spiral springs, operated by the rods giving extension and contraction to the yoke, in the manner and for the purpose herein set forth."

41. For an *Improvement in Artificial Legs;* Jonathan Russell, Philadelphia, Pennsylvania, August 17.

"The nature of my invention is so combining and arranging the several parts of an artificial leg, as that the knee joint shall be firmly locked by the weight upon it, when applied to either the toe or heel part of the foot, thus making the knee joint perfectly rigid, when the leg is erect, and the weight of the body or a portion of it is thrown upon it, at the will of the wearer."

Claim.—"Having thus fully described my invention, what I claim therein as new is, so operating the lever through the spring, by means of the cords, which are respectively attached to and operated by the toe and heel part of the foot, as that when the leg is bent forward or back on the ankle joint, the knee joint shall be locked by said lever, substantially as described."

42. For an *Improvement in Bedstead Fastenings;* William Shaw, Clarion, Pennsylvania, August 17.

Claim.—"What I claim as my invention is, the plug as above described, in combination with the clamp or clamps, for fastening bedsteads."

43. For an *Improvement in Hot Air Furnaces;* George S. G. Spence, Boston, Massachusetts, August 17.

Claim.—"Now I do not claim a descending draft as such, or an alternately descending and ascending draft; nor do I claim a draft divided and carried in different directions through several pipes or columns at a time; nor do I claim one undivided draft, carried through several pipes and columns at a time: but what I do claim as my invention is, the combination and arrangement of the ash or soot separate chambers and the flues, from whose external surfaces the heat is radiated into the air chamber of the hot air furnace; that is to say, I claim the combination and arrangement of the descending flue at and down the back of the fire place, the ash flue chamber, the ascending and descending arched pipe, the ash flue chamber, the ascending and descending arched pipe, the ash flue chamber, and the vertical flue discharge pipe, carried up against the back of the fire place, and having a communication with the fire place and a damper; all substantially as specified."

44. For an *Improvement in Machinery for Forming Hat Bodies;* Thomas Walker, City of New York, August 17.

Claim.—"Having described the construction and operation of the parts, I wish it to be

distinctly understood that the apparatus for picking and separating the fur forms no part of my invention, neither does the movable trunk, all these parts being well known and in ordinary use in cotton pickers and gins; neither do I claim retaining the fibre on the former by exhaustion by a blower, that being public property, having been shown in a patent issued to T. R. Williams, in England, in 1833; neither do I claim the use of water, to form the packing for the cylinder, that having been used in other machinery, and hot and cold water have been used in felting cloth and hat bodies; therefore, this forms no part of my claims.

"I do not limit myself to the screw, to raise and lower the former and trunk, as a rack and pinion or similar means may be used. But what I claim is, 1st, The combination of the water packed cylinder, former, and sliding and revolving shaft, for the purposes and as described.

2d, I claim giving alternate motion to the former and blower case, so that one is raised while the other is lowered, in the manner and for the purposes described.

"3d, I claim the hood, with its lining, by which steam or other gaseous pressure is made to force the bag or lining, on to the bat or former, in combination with the standing perforated pipe, or its equivalent, by which the bat is wetted through the perforations in the former, as described and shown."

45. For an *Improvement in Coloriferes;* Samuel Whitmarsh, Northampton, Massachusetts, August 17.

Claim.—"What I claim as my invention is, the combination of the water supply reservoir, the chamber or bed of sand, and a furnace or chamber of combustion; the whole being made to operate substantially as specified."

46. For an *Improvement in the Curriers' Beam and Knife;* James D. Willoughby, Carlisle, Pennsylvania, August 17.

Claim.—"What I claim as my invention is, the construction of a curriers' beam, with flaps on its edges furnished with springs and gauges, or their equivalents, for the purpose of dispensing with the kneeing, and prevention of cutting through, and production of regular thickness of leather.

"I also claim the construction of a knife, made adjustable by the eccentric handle or its equivalent, in connexion with the gauges or guides, substantially as and for the purpose set forth in the foregoing specification and accompanying drawings."

47. For an *Improvement in Processes for Making Paints;* Washington F. Davis, Assignor to Birdsill Cornell, City of New York, August 17.

Claim.—"I am aware that various mixtures of gelatine, albumen, gums, and gum resins have been used in watery solutions, for making a cheap paint that cover extensive surfaces; but such paints as the gums dry, crack, and leave fissures in the surfaces so covered, and have other defects; I do not, therefore, claim of use of watery solutions with such materials: but what I claim as my invention is, the use of a watery solution of the sulphate of zinc, to be mixed with white lead, zinc white, or other oil paints, in the manner herein set forth."

48. For an *Improved Fastener of Bits to Braces;* Erasmus Smith, Assignor to David Maydole, Norwich, New York, August 17.

Claim.—"Having described my improved hand drill or brace, what I claim as new therein is, the combination of the cam lever with the lever spring-catch, for securing the bit in the socket, and releasing it therefrom; the same being constructed, arranged, and operating substantially as described."

49. For an *Improvement in Manufacturing Cord Buttons;* Nelson Perkins, Wawarsing, New York, Assignor to Samuel Dow, Westfield, Massachusetts, August 17.

Claim.—"What I claim as my invention is, the preparation of the cords, in the process of manufacturing cord buttons, by gluing them together, substantially in the manner and for the purpose herein set forth."

50. For an *Improvement in Bill Registers;* J. N. Ayres, Stamford, Connecticut, August 24.

"The principal object of this invention is to show at a glance, to those persons in a counting house or other place of business, whose duty or wish it is to know, what bills are becoming payable or receivable every month, and their dates and amounts."

Claim.—"Having thus described my invention, I will now proceed to state what I claim:

"In combination with the perpetual calender in the same table, frame, or box, I claim the bill register, consisting of the strips or sheets of paper, or other material, suitably ruled for names and amounts, and inserted in or attached to the table, frame, or box, in any convenient way, so as to be easily removable or renewable, on either side of the columns of days of the month and week, under suitable headings, which denote whether the bills are payable or receivable, as herein substantially set forth."

51. For an *Improvement in Cooking Stoves;* Reuben J. Blanchard, Albany, New York, August 24.

"My improvement consists in introducing into the front and back flues, a separator, to divide the columns of heated gases, during a portion of their descent and ascent in these flues."

Claim.—"What I claim as my invention is, the placing the separators in the front and back descending and ascending flues of a cooking stove, to divide the products of combustion, while they are permitted to pass undivided over the top and under the bottom plates of the oven, substantially as described in the above specification."

52. For an *Improvement in Instruments for Lasting Boots;* Hezekiah Conant, Worcester, Massachusetts, August 24.

Claim.—"What I claim as of my invention is, the combination of the two levers, connected together and connected to the jaws, also connected to the step, by which combination, on opening the pincers, the simultaneous motion of the two jaws are guided, so as to take hold of both sides of the leather, and by pressing the handles towards each other, bring up the leather with equal tension on both sides. I claim this for the purpose and in form, substantially as above described."

53. For an *Improved Machine for Cutting Cheese;* Walter K. Foster, Bangor, Maine, August 24.

Claim.—"I do not claim the mere combination of a disk and spindle; but what I do claim as my invention is, the combination of the groove and the slot with the spindle and its sustaining board, so as to guide the point of the knife, and support the pointed end of the knife, when the knife is forced down through the cheese, as stated.

"And in combination with the groove, slot, and plate or board, I claim the secondary rotary board, to be applied and used substantially in manner and for the purpose as specified."

54. For an *Improvement in a Bed for Invalids;* Stevens D. Hopkins, Staunton, Virginia, August 24.

"The nature of my invention consists in arranging a frame, upon or within which any ordinary bedstead may stand, with a sheet, hammock, or mattress suspended from a carriage on top of said frame, so that it may be raised up or rest upon the bed, as the case may be, or removed from over the bed and used as a swing, for gently exercising or for removing the patient from one bed to another, without lifting, as is usually done."

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, suspending the sheet, hammock, or mattress, upon which the patient lies, to a carriage, which moves on a frame placed over or around a common bed, so that by said carriage the patient may be raised up or let down upon the bed, or moved from one place to another, or gently exercised; the whole being arranged, combined, and operating substantially in the manner described and fully shown."

55. For an *Improvement in Instruments for Lasting Boots;* Benjamin Livermore, Hartland, Vermont, August 24.

Claim.—"I do not claim as my invention the screw, the standard, the nut, or the arms; but what I do claim as my invention is, the mode of bringing the arms together, by the means of the slots in the arms, and the bolt operating in the slots, when this is used in combination with the standard, substantially in the manner herein described."

56. For an *Improvement in Signal Telegraphs;* Charles Latimer, Washington, District of Columbia, August 24.

"The nature of my invention consists in the arrangement of colored and white lights, one above the other, *into cornets* and numbers."

Claim.—"What I claim as my invention is, the formation of a complete system of telegraphic signals, by means of a vertical arrangement of white and colored lights, or their equivalents, by which any number and species of signals may be made with ease and simplicity."

57. For an *Improvement in Churns;* Rufus Maxwell, Lewis County, Virginia, August 24.

Claim.—"I claim, 1st, the forcing of the milk through a rack, by revolving the churn in an orbit, without turning it on its axis.

"2d, The bow and rods connected together, as above described."

58. For an *Improved Abutment Motion for Reversible Rotary Engines;* Cassius A. Mills, Coldwater, Michigan, August 24.

Claim.—"What I claim as my invention is, the combination, for the purpose of withdrawing the sliding heads at proper intervals and returning them, whichever way the engine is working, of the rods, the levers, the wheels, with their wedge-shaped projections or inclines, and the springs; the whole arranged and operating in any way substantially as set forth."

59. For an *Improvement in Machines for Cutting Hand Rails;* George B. Pullinger, Philadelphia, Pennsylvania, August 24.

Claim.—"What I claim as my invention is, arranging the rollers, one above the other, within a revolving frame, so as to allow the curved roller, or its equivalent, being substituted for the roller at the time desired, and in the manner and for the purpose herein fully specified."

60. For an *Improvement in Horse Power;* David Russell, St. Louis, Missouri, August 24.

"My improvement consists of a novel method of employing the power of horses, by which their weight as well as draft is rendered available, and by which the velocity of the running parts is not reduced, by extending the circle or sweep upon which the friction wheel travels."

Claim.—"Having thus fully described my improved horse power, what I claim therein as new is, 1st, the combination of the canting tread wheel, the horizontal sweep shaft, and friction wheel, for producing motion, in the manner described, by which the wheel is always running down hill, by throwing the weight of the horse on to the canting wheels just forward of it, as above described."

61. For *Improvements in Mechanism for Griping Wood Screw Blanks, &c.;* Thomas J. Sloan, City of New York, August 24.

Claim.—"What I claim as my invention for operating the griping jaws on the mandrels of machines for threading or shaving the heads of wood screws, is, the employment of a wedge on a stem within the mandrel, to act on the jaws, to close them, substantially as specified, when the said wedge stem is combined with a sliding frame, or its equivalent, by means of an interposed spring, substantially as specified, for the purpose of adapting the jaws to the griping of blanks of various sizes, as set forth.

"And I also claim, in combination with the said spring connexion, for the purpose specified, the making of the wedge faces curved, substantially as specified, to insure an equal or nearly equal force on the griping jaws, as set forth."

62. For an *Improvement in Threading Pointed Wood Screws;* Thomas J. Sloan, City of New York, August 24.

Claim.—"What I claim as my invention is, giving to the mould or former, or its equivalent, motion, substantially as specified, whereby the cutting away of the metal at the end of the shank is divided amongst several threading motions, instead of being cut away at the first threading motion, as heretofore practised."

63. For an *Improvement in Railroad Truck;* Edwin Stanley, Bennington, New York, August 24.

Claim.—"I claim as my invention, 1st, the combination of the brake with the wheel and rail, arranged and operating substantially as described.

"2d, Making the wheel substantially as herein described, for the purposes of preventing from clogging with snow, or other substances, and giving it a better hold upon the rail, as above suggested."

64. For an *Improvement in Apparatus for Feeding Boilers;* Andrew Walker, Jr. Johnsbury, Vermont, August 24.

Claim.—"What I claim as my invention is, the combination of the heater or vessel and its pipes and stop cocks, or either of them, with the tank, boiler, and force pump, so as to operate therewith, or enable the force pump to be operated, substantially in manner and under the circumstances as above set forth."

65. For an *Improvement in Mills for Mashing Vegetables and Mixing Clay;* Clark Alvord, Geddes, New York, August 31.

Claim.—"What I claim as my invention is, the use of grated hollow cylinders, operating together, so that the grates of one cylinder must be between the grates of another cylinder of like construction, thereby forcing the material operated upon from the periphery of the cylinder or cylinders to the inside of such cylinder or cylinders, thereby mashing, grinding, and mixing the same, as above set forth."

66. For an *Improved Reverberatory Furnace;* Christopher G. Best, Albany, New York, August 31.

Claim.—"I claim the reverberatory furnace, constructed as described; the fuel with the fire box being above the metals to be melted in the chamber, and bringing the flame and heated products of combustion vertically down through the metals in the chamber, in the manner and for the purposes set forth."

67. For an *Improvement in Wash Boards;* Lester Butler, Kenoshu, Wisconsin, August 31.

Claim.—"What I claim is, the curved or circular form of the crimp, giving a better chance for the suds and water to remain amid the clothes during the process of rubbing, and also keeping the water near the centre of said board; thus rendering the work easier than the old fashioned form."

68. For a *Roller Saw-Set;* Abel Bradway and Elijah Valentine, Monson, Massachusetts, August 31.

Claim.—"Having fully described our improved saw-set, what we claim therein as new is, the stamps alternating with the spaces upon the end of a cylinder, in combination with a beveled cylinder, which is caused to revolve with equal velocity in the direction opposite to that of the cylinder, arranged in the manner and for the purpose substantially as herein described."

69. For an *Improvement in Kilns for Pottery;* George R. Booth, Hanley, England, August 31; patented in England, June 15, 1843.

Claim.—"What I claim as my invention is, the arrangement of the fire hearth below the oven bottom, and provided with suitable apertures for the admission of air, to regulate the combustion, substantially as described, when this is combined with the oven or heating chamber, provided with a tube, or the equivalent thereof, as specified, for discharging the heat above the bottom of the oven, and diffusing it in the oven, and also provided with outlet flues or apertures at or near the bottom, and with apertures or tubes at or near the top of the discharge of gases or steam, all substantially as herein described and for the purpose specified."

70. For an *Improved Blind Operator and Fastener;* James R. Creighton, Cincinnati, Ohio, August 31.

"My improvements consist in a method of opening, closing, and fastening window blinds from the inside, by machinery which passes from the inside, under the stool and through the subsill; the motion of the blind being accomplished by a straight shove out or pull in, as the case may be, such a motion only requiring a straight mortise through the subsill."

Claim.—"Having thus described the nature of my improvement in blind operators, what I claim therein as new is, the combination and arrangement of the sliding plate, provided with a notch and extension rod and handle, with the vibrating link and fastening, and with the catch and notches, by which I am enabled to operate a blind from the inside, by a straight shove or pull, as the case may be, and to fasten it shut or partially open, as required."

71. For an *Improvement in Artificial Legs;* John S. Drake, City of New York, August 31.

Claim.—"I do not claim the use of a spring to throw the lower part of the leg forward, but I am not aware of any straight or curved spring having been used with a skeleton knee, as herein shown. I do not claim the open skeleton, to receive the stump, as the ordinary wooden legs have been secured by straps and bands, acting in the same manner and for the same purpose.

"What I claim is, 1st, the skeleton knee piece, in combination with the spring, attached at its ends to the upper and lower parts of the leg, as described and shown.

"2d, I claim the arrangement of the spring toes on their centre, kept down by the spring, as described and shown.

"3d, I claim the locking piece and hook, to allow of the bending of the leg, as described and shown."

72. For an *Improvement in Oil Cans;* Samuel Field and Charles W. Heald, Barre, Massachusetts, August 31.

Claim.—"What we claim as our invention is, the combination of the receiving chamber, D′, with the chamber, D, and flanch, L; the whole being constructed, and arranged, and operating in manner and for the purpose substantially as herein set forth and specified."

73. For *Improvements in Printing Press;* George P. Gordon, City of New York, August 31.

Claim.—"Having fully described and explained my improvements, I do not claim the periphery of a cylinder as a distributing surface for the ink, nor the segment of the cylinder, to form a place for the form of type, sô arranged by catches and stops that it may be turned over any distance, to receive the form, as in the Voorhies press; but what I do claim is, the arrangement and application of a cylinder which always remains stationary in its own position, as well while receiving the form as when used as a distributing surface.

"I do not claim an arm or single frame, to carry one set of rollers around the periphery of a cylinder, as in the Voorhies press; but I do claim the combination and arrangement of several sets of rollers in one frame, to traverse round the periphery of a cylinder, when these sets of rollers alternately or consecutively pass over the form, and admit an impression to be taken, between the time one of the sets leaves the form and the next set arrives to it, for the purpose of giving slow motions to the inking, with rapid impressions upon the same form; thus effecting more speed, as regards the amount or number of impressions to be produced in a given time.

"I do not claim the continuous sheet, nor feeding a continuous sheet of paper to a printing press; but I do claim the arrangement of the gauge, 1, guides, 2, pawl, *r*, cranks, *s* and *d*′, rod, E′, pin, *f*, and wheels, *a*′, in combination with the shears for cutting off the sheet after it is printed, and the cam, *y*, from which it receives its motion; the whole of these parts operating as described; all of which is herein fully described and set forth."

74. For an *Improvement in Washing Machines;* Jarvis T. Mudge, Washington, District of Columbia, August 31.

Claim.—"Having described my improvement, what I claim as my invention is, the providing a washing machine with a hinged flap rubbing board, or its equivalent, for turning the clothes in the tub, in combination with the dasher and hinged presser, for the purposes set forth and shown in the specification and accompanying drawings."

75. For an *Improvement in Governor for Steam Engines;* George S. Stearns and Wm. Hodgson, Cincinnati, Ohio, August 31.

Claim.—"What we claim as new is, the combination of the quadrants and the cylindrical rack, arranged and operating substantially as set forth; not confining ourselves to the cylindrical form of the rack; other forms may be used, if found to suit, such as square, or any polygon form."

76. For a *Process for Restoring Shape and Tempering Articles of Hardened Steel;* John Silvester, West Bromwich, England, August 31; patented in England, July 17, 1850.

Claim.—"And having now described my said invention, and the manner in which the same is to be performed, I declare that what I claim is, the curing or remedying the distortion which has taken place in steel plates during the operation of hardening, by com-

pressing them between dies, previously heated to a sufficient degree to "bring back" or "let down" the temper; the mechanical pressure to be applied while the plates are in the course of being tempered, (the pressure being continued during the process of tempering,) as before exemplified and described."

77. For an *Improvement in Brick Machines;* Arad Woodworth, 3d, and Samuel Mower, Boston, Massachusetts, August 31; patented in England, January 24, 1852.

Claim.—"Having described our improvements, what we claim as of our invention is combining with the percussion machinery, the lower piston or pistons and machinery, to produce a compression of the bottom surface of the brick, and machinery to produce a compression of the top surface of the brick; the whole being substantially as herein before described; not meaning such compression of the same as is produced by the percussion of the ram, but a separate compression, effected by other means, as described.

"We also claim the improvement of constructing each of the orifices of the mould charger with flaring or inclined sides, inclining inwards towards each other as they descend; the whole being substantially in manner, and to effect the object or overcome the difficulty, herein before stated.

"We also claim the improvement of combining with the adjustable gate, or striker, a mechanism that will cause it to rise upwards as the mould charger moves forwards towards the moulds; such rising upwards of the striker being for the purpose herein before explained."

78. For an *Improved Metallic Stuffing-Box Packing in Steam Engines;* Ebenezer Winship, City of New York, August 31.

Claim.—"Having fully described my invention, what I claim therein as new is, the combination of an elastic ring, made to fit tightly on the rod and loosely in the stuffing box, and having an intercepting tongue and spring plate, to prevent the steam from escaping through the slot therein, with the plate, or its equivalent, fitting tightly over the ring, and loosely encircling the rod, and the gasket, or its equivalent, above said plate, substantially as described."

79. For an *Improvement in Electro-Magnetic Fire Alarms;* Henry Van Ansdall, Preble County, Ohio, August 31.

Claim.—"I claim the combination and arrangement of a signal wheel with two elastic circuits, so that when one is broken the wheel may revolve, and operate a key in the other circuit.

"2d, I also claim the mode of constructing an elastic circuit, by breaking, tapping, and binding with a combustible material, or equivalent, for the purpose of making it sensitive to fire, as herein described."

Re-issues for August, 1852.

. For an *Improvement in the Manufacture of Bullets, &c.;* George W. Campbell, City of New York, dated November 20, 1847; re-issued August 3, 1852.

Claim.—"I do not therefore claim as of my invention, casting bullets, buckles, and other articles, in a series of moulds moving under a spout, when the surface on which the lead is poured is unbroken; nor do I wish to limit myself to the precise construction of moulds, nor to the special arrangement of them, so long as the same results are produced by equivalent means. But what I claim as my invention in the method of casting bullets, &c., in a succession of connected moulds, is, jointing them together, so that they shall separate and come together in vertical planes, at right angles to the line of motion of the series, or nearly so, substantially as and for the purpose specified."

. For an *Improvement in Making Lamp Black;* John G. Muir, Philadelphia, Pennsylvania, dated November 13, 1844; re-issued August 24, 1852.

Claim.—"What I claim as my invention and improvement is, the mode herein described of burning lamp black, that is to say, burning it in a confined building or room, without chimney or draft, substantially in the manner set forth in the above specification."

Designs for August, 1852.

. For a *Design for a Cooking Stove;* Samuel Eberly, Mechanicsburg, Pennsylvania, August 3.

Claim.—"What I claim as new is, the combination of the ornaments with the panels raised on the *surface of the side plate* of the stove."

2. For a *Design for a Water Cooler;* Patrick Molony, Cincinnati, Ohio, August 3.

Claim.—"What I claim as my production is, the design and configuration of an ornamental water cooler, substantially as described and represented in the annexed drawings."

3. For a *Design for a Cooking Stove;* Russell Wheeler and Stephen A. Bailey, Utica, New York, August 3.

Claim.—"We do not claim the exclusive right to the general construction of the stove; but what we do claim is, the design and configuration of the ornaments and mouldings, as described and set forth in the accompanying drawings."

4. For a *Design for a Cooking Stove;* Garretson Smith, Henry Brown, and Julius Holzer, Assignors to North, Harrison, and Chase, Philadelphia, Pennsylvania, August 3.

Claim.—"What we claim as our invention is, the design and configuration of the mouldings, conical rods, petals, rosette, scroll, and foot, as herein described."

5. For a *Design for a Grate Frame and Fender;* James L. Jackson, City of New York, August 10.

Claim.—"What I claim therein as new is, the combination and arrangement of the ornamental figures herein represented."

6. For a *Design for a Grate Frame and Fender;* James L. Jackson, City of New York, August 10.

Claim.—"What I claim therein as new is, the combination and arrangement of the ornamental figures herein represented."

7. For a *Design for a Grate Frame, Summer Piece, and Fender;* James L. Jackson, City of New York, August 10.

Claim.—"What I claim therein as new is, the combination and arrangement of the ornamental figures herein represented."

8. For a *Design for a Cooking Stove;* Frederick Schultz, Assignor to William P. Cresson, District of Northern Liberties, Pennsylvania, August 10.

Claim.—"What I claim as my invention is, the ornamental designs for a flat top cooking stove, as herein described and arranged, and represented in the annexed drawings."

9. For a *Design for a Stove;* Jacob Beesley and Edward Delany, Assignors to William P. Cresson, Philadelphia, Pennsylvania, August 10.

Claim.—"What we claim as our invention is, the ornamental designs for a nine-plate stove, as herein described and represented in the annexed drawings."

10. For a *Design for a Cooking Stove;* Jacob Beesley, Assignor to Richard Peterson, Philadelphia, Pennsylvania, August 10.

Claim.—"What I claim as my invention is, the ornamental designs for a stove, called the Complete Cook, as herein described, and represented in the annexed drawings."

11. For a *Design for a Parlor Stove;* Dutee Arnold, Providence, Rhode Island, August 17.

Claim.—"What I claim as my production is, the new design, consisting of the bead and lattice work, and human figures, herein above described and represented in the drawings."

12. For a *Design for a Six Plate Stove;* Samuel F. Pratt, Boston, Massachusetts, Assignor to Jagger, Treadwell & Perry, Albany, New York, August 17.

Claim.—"What I claim as my production is, the combination and arrangement of ornamental figures and forms represented in the accompanying drawings, forming together an ornamental design for a six plate stove."

13. For a *Design for a Cooking Stove;* John S. Perry, Assignor to Jagger, Treadwell & Perry, Albany, New York, August 17.

Claim.—"What I claim as my production is, the combination and arrangement of ornamental figures and forms represented in the accompanying drawings, forming together an ornamental design for a cooking stove."

14. For a *Design for a Cooking Stove;* John S. Perry, Assignor to Jagger, Treadwell & Perry, Albany, New York, August 17.

Claim.—"What I claim as my production is, the combination and arrangement of orna-

mental figures and forms, represented in the accompanying drawings, forming together an ornamental design for a cooking stove."

15. For a *Design for a Parlor Stove;* Ezra Ripley, Assignor to Nicholas S. Vedder, Troy, New York, August 31.

Claim.—"What I claim as new is, the ornamental design and configuration of stove plates, the same as herein described and represented in the annexed drawing."

16. For a *Design for a Parlor Stove Plate;* Samuel A. House, Mechanicsville, Assignor to Hiram House, Troy, New York, August 31.

Claim.—"What I claim as new is, the ornamental design and configuration of stove plate, the same as herein described and represented in the annexed drawings."

17. For a *Design for the Top and Front Plates of a Parlor Stove;* Samuel A. House, Mechanicsville, Assignor to Hiram House, Troy, New York, August 31.

Claim.—"What I claim as new is, the ornamental design and configuration of parlor stove top and front plates, the same as herein described, and represented in the annexed drawings."

18. For a *Design for Parlor Stove Front;* Samuel A. House, Mechanicsville, Assignor to Hiram House, Troy, New York, August 31.

Claim.—"What I claim as new is, the ornamental design and configuration of stove front, the same as herein described, and represented in the annexed drawings."

SEPTEMBER.

1. For an *Improvement in Smoothing Irons;* Fedral C. Adams, Aberdeen, Ohio, September 7.

Claim.—"What I claim as my improvement is, 1st, the basket grate, formed by the bars, as mentioned in the specification.

"2d, I claim the concave form in the top of the smoothing portion of the iron, all for the purposes set forth."

2. For an *Improvement in Machines for Making Carriage Wheels;* Chauncey H. Guard, Brownville, New York, September 7.

Claim.—"What I claim as my invention is, the manner of feeding up the boring spindle slowly, and bringing it back speedily, whilst the driving spindle is turned constantly in one direction, and with the same velocity, viz: by connecting the driving spindle to the boring spindle, by means of the collared bar, and by a cog-wheel on the former, gearing into a pinion on the latter, and by screw threads formed upon the said spindles, which can be alternately operated upon by the segmental nut which is placed between them, and actuated by the lever, substantially as herein set forth."

3. For an *Improvement in Refrigerators of Wort;* Adolph Hammer, Philadelphia, Pennsylvania, September 7.

Claim.—"What I claim as new is, the series of deep, narrow, open chambers, when made with vertical partitions so as to form passages at the bottoms thereof, for imparting to the wort a direction downward and upward, through the said chambers, in combination with shallow chambers, with which the aforesaid chambers successively communicate, and the enclosed chambers, through which flows, in direction opposite to that of the wort, a current of cold water, in the manner and for the purpose herein set forth and shown in the drawing."

4. For an *Improvement in Apparatus for Feeding Chickens;* Simeon W. Albee, Walpole, New Hampshire, September 7.

"The nature of my invention consists in attaching and arranging doors to a suitable case in such manner, that said doors will be opened inwardly by the fowls, when they tread upon steps connected by levers and rods, or their equivalents, to the doors, as will be hereafter described."

Claim.—"I do not claim attaching and arranging the doors to the case, so that said doors will open outwardly, as that has been previously done; but what I claim as new is, attaching and arranging the doors to the case in such manner that said doors will open inwardly instead of outwardly, when the fowls tread upon the steps; the doors being attached to the case and arranged as described, or in any equivalent way."

5. For an *Improvement in Railroad Signals;* Aurin Bugbee, Charlton, Massachusetts, September 7.

Claim.—"I do not claim the simple combination of a bell hung to a spring, a cord or chain leading therefrom, and a tripping lever or apparatus, which when moved in one direction, shall pull the cord and cause the bell to vibrate, as this is a well known combination applied to doors, for the purpose of sounding an alarm; but what I do claim as my invention is, the combination of a single bell, a spring, two cords, and two or more tripping arms or levers, as applied to a railway and supporting frame, at a road crossing of such railway, and so that the contraction of one of the two ropes, by change of temperature, or otherwise, may be counterbalanced by that of the other, and not draw the bell laterally out of place, as it would be likely to, were but one rope or wire used.

"And I claim the combination of the weighted or heavy flag, or signal board, with its suspension chains or cords, the windlass barrel, the over balance weight or weights, and suspension cords or chains, the leading cord passing over the pulley, the tripping lever, the spring catch, and its cord, and the tripping lever or arm; all being arranged and made to operate together, substantially as specified."

6. For an *Improvement in Preserving India Rubber;* Frederick Bronner, Vera Cruz, Mexico, September 7.

Claim.—"The nature of my discovery is, by applying the before mentioned quantity of campeche salt or muriate of soda to the rubber, in its sap state, and that by so doing, to prevent putrefaction and fermentation of the juice, to which more especially I confine the claim of my invention."

7. For an *Improvement in Grain Harvesters;* Daniel Fitzgerald, County of New York, New York, September 7.

"*Claim.*—"What I claim is, 1st, the arrangement and combination of two cylinders with each other, for the purpose of cutting, and bringing the cut grain into the middle between them, and delivering the same to the crib, as above described.

"2d, The construction of the cam cutter, and cam fingers so constructed, as to be drawn in, for the purpose of allowing the cylinders to throw the cut grain into the crib, as above described.

"3d, The use of a sloat or channel, to regulate the movement of the fingers, as above described.

"4th, The arrangement and construction of a crib, made to receive from the two cylinders, and hold the cut grain upright, so that it can be readily taken out for binding, in the manner above described."

8. For an *Improvement in the Manufacture of Common Salt;* James P. Haskin, Syracuse, New York, September 7.

Claim.—"What I claim is, the use of a screen, false bottom, or floor, in the vat or pan. containing saline waters, or brine, for manufacturing salt, to separate impurities or bitterings from the salt, substantially as herein described, or any other mode substantially the same."

9. For an *Improvement in the Manufacture of Sulphuric Acid;* Carl Hiwuchs, City of New York, September 7.

Claim.—"What I claim as my invention is, concentrating sulphuric acid in leaden vessels, to the strength of 66° Baume, and at a temperature below the boiling point of the acid.

"I also claim the long conducting and escape pipe, in combination with the agitating apparatus, for condensing the deleterious gases, and preserving a pure and wholesome air in the neighborhood of the establishment."

10. For an *Improvement in Composition of Enamels;* John G. Dunn and Alfred F. Howes, Lawrenceburg, Indiana, September 7.

Claim.—"What we claim as our invention or production is, the enamel herein before described, and of its application to brick and iron."

11. For *Improvements in Apparatus for Heating Feed Water of Locomotives, etc.;* Israel P. Magoon, St. Johnsbury, Vermont, September 7.

Claim.—"What, therefore, I claim as my invention is, to combine the vessel, H, with the deflector, R, the heater, W, and the chimney pipe, P, substantially as described, whereby such deflector shall not only form the bottom of the said vessel, H, but that the smoke

and exhaust steam may be made to heat said vessel, by impinging against the deflector, as specified.

"And I also claim the improvement of throwing the waste steam directly into the heater or vessel, H, and there partially or wholly condensing it, before it is passed into the tank of the tender: not meaning to claim the throwing of it into the tender from the blast pipe, and through a single pipe, connecting the blast pipe and tender, but the combining the tender and the blast pipe, E, and the heater or vessel, H, by pipes, substantially in the manner represented in the drawing, whereby the advantages herein before stated, as well as others, are obtained."

12. For an *Improvement in Whiffle-tree Hook;* Edwin A. Palmer and Adolphus J. Simmons, Clayville, New York, September 7.

Claim.—"What we claim as our invention is, the head, turning upon the shaft, to close the hook, the sliding catch to prevent its opening, and the spring within the head acting upon them; the whole combined and operating substantially in the manner specified."

13. For an *Improvement in Air-Tight Mail Bags;* Charles A. Robbins, Iowa City, Iowa, and Harvey Allen, Allen Grove, Wisconsin, September 7.

Claim.—"We are aware that hinged clasps or clamps have been used for drawing together and keeping closed the mouth of the bag; such, therefore, merely of themselves, we do not claim: but what we do claim as our invention is, forming the jaws of the clasp with a tongue and groove on their inner faces, for crimping in the elastic material of the bag, and causing it to act as packing, in effectually making air and water-tight the mouth of the bag, as herein shown and set forth."

14. For an *Improvement in a Blow Pipe for Dentists, &c.;* Julius Thompson, North Bridgewater, Massachusetts, September 7.

Claim.—"Now I do not claim the connecting a common blow pipe with a bellows by means of either a flexible or inflexible tube; nor do I claim the invention of a lamp for blow pipe purposes, which may be operated with a burning fluid, or oil, or any other combustible substance; nor do I claim the use of a gas flame for blow pipe purposes, instead of a spirit or other flame: but what I do claim as my invention is, 1st, The combination in one instrument of the flame of gas or a lamp with a blow pipe, so that both operating together, may be held in one hand, and the flame applied on any spot, in any direction, and for any length of time, at the will of the operator.

"2d, The arrangement of the thumb piece, or its equivalent, in combination with the flame of gas, or a lamp, and a blow pipe, so that while the instrument is held in one hand, a movement of the thumb will adjust the blow pipe to the flame in such a way as to produce any desired variation in the flame, as above described and set forth.

"I do not intend by this claim, as I have intimated above, to restrict myself to the mode of construction herein or above described, but to reserve the right to vary the same as I may deem expedient, while I attain the same ends by means substantially the same."

15. For an *Improvement in Preparing Stone in Imitation of Marble;* Hiram Tucker, Cambridgeport, Massachusetts, September 7.

Claim.—"What I claim as my invention is, the improvement in preparing the surface of the slate, or absorbent stone, or mineral matter, for better receiving and retaining colors, and for its quicker and better induration, than by the ordinary process of baking oil or japan on it; the same consisting in applying a drying oil or vehicle to it, as above set forth, in combination with baking it and charring it, or with burning it thereon, essentially as above specified, the charring or burning the oil being the principal of my invention or discovery, under the circumstances as stated.

"And I also claim the improvement in applying the veining and ground colors to such indurated surface, or other surface, the same consisting in applying the graining colors first, and drying them on, in combination with subsequently covering the whole surface, together with such veining colors with one or more coats of black or other colored japanning, and after the same has been dried, grinding down japanning from the veining colors, and leaving it between them, so as to form a ground as stated."

16. For a *Method of Making Lamp Tops Rivets, &c.;* Luther C. White, Meriden, Connecticut, September 7.

Claim.—"What I claim as my invention is, the method of making lamp tops stoppers, rivets, and other similar articles, from a disk or plate of metal, by bending it and forming it, substantially as described, so that the rim is formed of two thicknesses of metal, and the centre and flanch of one thickness, as described."

MECHANICS, PHYSICS, AND CHEMISTRY.

On the Iron-making Resources of the Kingdom, and the First Process in Iron-Making. By S. H. Blackwell, Esq., of Dudley, F. G. S.*

The lecture commenced with a graceful reference to the Crystal Palace, which had brought so prominently into notice the great iron-making resources of the kingdom, and the extraordinary perfection to which some of the branches of that manufacture had attained, while it illustrated no less how those resources underlie all the departments of our manufactures, and form the basis on which all progress must rest.

The history of the iron trade may be divided into two periods—the first, terminating at 1740, when coal was introduced as fuel for smelting; the second, extending to the present time.

In 1615 there were in the whole kingdom 800 furnaces, yielding 180,000 tons; and in 1740 these had declined to 59 furnaces, producing 17,350 tons. At this period coal was introduced, and the rise was thenceforward rapid; in 1788, 70,000 tons; in 1800, 180,000; in 1825, 600,000; and in 1851, 2,500,000. In the same year, the exports of pig iron were upwards of 1,200,000 tons, besides tin plates, hardware, cutlery, and machinery, bearing a total value of £10,424,139.

The causes of this wonderful increase are mainly three—the rapid expansion of our arts and manufactures; the improvements in machinery; but, above all, the vast supplies of coal and iron contained in our mineral fields, and their happy proximity to each other, by which the ore and the coal for its smelting are obtained from the same working.

A class of ores is likely to prove so important, that some notice of it must be given. It commences on the north-east coast of England, at the river Tees, and stretching through York, Lincoln, Northampton, Oxford, and Dorset shires, is at Lyme-Regis diverted by the granite formations of Devon. Its discovery was first made at Middlesboro', between two and three years ago, where the bed is fifteen feet thick, and contains thirty per cent. of iron; and so low is the cost of its production, that the manufacturers of that district have been enabled to compete with the maker of iron from the Scotch black bands. Some idea of the extent to which this bed will ultimately be worked, may be gathered from the fact, that although the workings have been so recently commenced, 200,000 tons of stone were raised by one firm alone in the course of the past year. This ore differs in appearance and structure from any other, and on this and other accounts, although the existence of the bed in Northamptonshire had been long known, and traces of the ancient workings were to be found, it had been neglected, and it was only by the Exhibition that its extent and value had been ascertained. The supply of this iron-stone may be fairly considered as inexhaustible—that from Higham-Ferrers, in Northamptonshire, where many tracings of ancient workings have been found, yielding 55 per cent. of iron.

The lecturer then proceeded to notice the improvements in the manufacture, by which, in little more than a century, a larger quantity is now

* From the London Practical Mechanic's Journal, July, 1852.

produced by two furnaces than by the whole number in blast in 1740; while, by several single firms, fivefold the whole make of the kingdom at that period is produced.

The reduction in prices resulting from these improvements has naturally been very great, and pig iron has now fallen from 8*l.* per ton, the average in 1820, to 2*l.* 12*s.* 6*d.* It is not uninstructive to remark, that the quantity exported in the past year, with the duty on foreign iron at 30*s.*, is double the entire make of the kingdom in 1825, when the duty was reduced from 6*l.* 10*s.*

Not the least interesting part of this important history, is the consideration of the obstacles opposed by prejudice and ignorance to each successive improvement. Although the use of coal was attempted as early as 1620, the opposition on the part of the workmen was such, that its successful application did not take place till more than a century later. For a long time the most eminent firms refused to make use of the hot-blast, although now more than $\frac{19}{20}$ths of the whole produce of the country are made with it; and the application of the waste gases, although adopted most successfully in Scotland, Derbyshire, and South Wales, has hitherto failed to make its way into South Staffordshire.

An important result of the Exhibition is the acquaintance it has given us with the iron manufactures of other countries, which, in many cases, showed an excellence which we have not yet attained, but which we must reach if our pre-eminence is to be maintained. It is a dangerous mistake to suppose that we are possessed of any exclusive skill in manufacture, or that our immense natural advantages will enable us to retain the position which we hold without straining every nerve to do so. The lecturer concluded by warning the Anglo-Saxon race, "to whom work is less a toil than a passion," that with their faculties and natural privileges, they also bear the responsibility of the progress of the world.—*Proc. Soc. Arts, April* 7, 1852.

For the Journal of the Franklin Institute.

Remarks on the U. S. Steamship Susquehanna. By B. F. Isherwood, Chief Engineer, U. S. Navy.

In 1847, the United States Navy Department commenced the construction of the four steamships-of-war, *Susquehanna*, *Powhatan*, *Saranac*, and *San Jacinto*, all of which are now completed, the latest, the *Powhatan*, having made a trial trip in May last.

The *Susquehanna* left the United States on her first cruise, in June, 1851, for the East Indies, by the way of the Cape of Good Hope, and returns have been received up to January, 1852, which show her to have been signally fortunate on her passage, being favored with fine weather nearly the whole time, and with fair winds during a long portion of it; consequently, she was able to derive very great benefit from the use of her sails. Owing to the same cause, there were no opportunities for testing her steam capabilities, as the engines were not worked with wide throttles and all furnaces in operation for a sufficient length of time to obtain reliable average data; from the same cause, likewise, and the

EHANNA.

ent them from impeding the Vessel's speed.

Boilers.			Speed of the vessel in feet per hour.	Speed of the centre of pressure of the paddles in feet per hour.	Slip of the centre of pressure of the paddles per centum.
Number of furnaces of the boilers in operation.	Pounds of coal consumed per hour.	Kind of Coal.			
6 for 12 hs. and 4 for 96 hours.	1674	Mixed patent fuel and Newcastle.	47631·18	45160·63	
8	1762	Do. do. do.	45536·01	44154·16	
6	2054	Cumberland bituminous.	53922·84	47411·64	
4 for 72 hs. and 6 for 52 hours.	1620	Do. do. do.	51702·66	55638·22	
6 for 60 hs. and 4 for 24 hours	1900	Newcastle bituminous.	48661·33	45127·60	
6 for 24 hs. and 5 for 12 hours.	1962	Do. do. do.	57260·47	56750·98	
5	1797	Bituminous.	50064·68	47927·70	
7 for 8 hs. and 6 for 8 hours.	2775	Cumberland bituminous.			12·77
8 for 60 hs. 9 for 32 hs. and 7 for 12 hours.	3317	Do. do. do.			10·78
12 for 96 h. 10 for 24 h. and 8 for 60 hours.	3433	Do. do. do.			18·94
9·43	3358	Cumberland bituminous.			
12	4084	Cumberland bituminous.			21·39
8 for 24 hours. 9 for 93 hs. and 10 for 72 hs	3565	Do. do. do			22·45
10	4270	Do. do do.			22·10
12	4288	Do. do. do.			19·46
9 for 34 hours. 10 for 10 h' and 8 for 16 hours.	3808	Do. do do.			19·18
10 for 12 h. and 9 for 20 hours.	3340	Do. do. do			19·05
8	3966	Duffryn, (Welsh)			17·00
6 for 32 hs. and 8 for 80 hours.	3183	Do. do. do.			18·10
8 for 16 hs and 6 for 4 hours.	3245	Do. do. do.			20·63
10	3432	Do. do do.			18·08
10 for 24 h and 6 for 12 hours	3067	Do. do. do.			19·35
8	3956	Newcastle bitumin's			17·42
6	2279	Liverpool "			18·83
6	2120	Do do. do.			21·31
8·444	3279	Semi-bituminous.			19·73

Statistics of the Machinery of the Susquehanna.

	Weight of material in a finished state. lbs.	Finished Surfaces. sq. in.	Labor. No. of Days.	Total Cost. Dolls. Cts.
Engines (complete) with paddle wheels, engine room, floor, &c., &c.				
Weight of material in a finished state.				
Cast iron, 350,688 lbs.				
Wrought iron, 310,544 "				
Brass Composition, 54,596 "				
Copper, 21,398 "				
Steel, 1,776 "	739,002			
Finished Surfaces.				
Planing, 81,541 sq. in.				
Boring and turning, 662,859 "		744,380		
Day's Labor.				
Number of days' work fitting, 19,562				
No. of days' work of laborers, 1,161			20,723	165,065·53
Boilers.				
Weight of material in a finished state.				
Copper plates and bolts, 313,845 lbs.				
Brass composition, 10,437 "	324,282			121,491·67
Appurtenances to boilers, viz: smoke pipe, jackets, holding down bolts, furnace and flue doors, grate bars, safety, feed, blow, and steam stop valves, water pans, fire room floor, &c., &c.				
Weight of material in a finished state.				
Cast iron, 60,783 lbs.				
Wrought iron, 20,684 "				
Brass composition, 4,832 "				
Copper, 2,652 "	88,951			
Finished surfaces.				
Planing, 5,365 sq. in.				
Turning and boring, 20,998 "		26,363		
Days' labor.				
Number of days' work fitting, 286				
No. of days' work of laborers, 227½			513½	8,973·44
Coal bunkers and bulkheads, engine room, galley, &c.				
Weight of material in a finished state.				
Cast iron, 19,121 lbs.				
Wrought iron, 99,281 "				
Brass composition, 461 "	118,863			13,909·14
Patterns.				
Days labor on patterns, 2219			2,219	7,867·43
Duplicate pieces, tools, stores, outfits, &c.				
Weight of material in a finished state.				
Cast iron, 55,910 lbs.				
Wrought iron, 9,813 "				
Composition, 6,631 "				
Copper, 471 "				
Steel, 59½ "	72,884½			
Finished surfaces.				
Planing, 732 sq. in.				
Turning and boring, 1040 "		1,172		
Days' labor.				
Number of days' work fitting, 377				
No. of days' work of laborers, 10			387	7,263·17
Totals,	[illegible]	772,615	23,842½	[illegible]

Performance.

Performance under Sail alone, with Paddles removed.

The performance of the *Susquehanna* at sea, under sail alone, with the paddles removed, was for three consecutive days as follows, viz:

July 8, 1851,	178·25 knots.	
July 9,	"	174·00 "
July 10,	"	175·00 "

Mean speed per hour, 7·323 knots.

During this period, the course of the vessel was S.W.½W.; the wind was a moderate breeze from N. E., or directly aft. All sail was carried that could be advantageously set.

With the course of the vessel and the strength of the wind, as above, but the direction of the wind being from the E., or on the port quarter, all sail set as before, the speed of the vessel was as follows, viz:

July 11, 1851,	150·50 knots.	
July 12,	"	159·25 "
July 13,	"	159·50 "

Mean speed per hour, 6·517 knots.

On the 14th July, 1851, the course of the vessel and direction of the wind being the same as in the last paragraph, but the wind being only a light breeze, the vessel made but 99 knots, or 4·125 knots per hour.

Throughout all the above sailing, the sea was smooth and the weather fine; mean draft of the vessel, about 19 feet.

The above is all that is recorded in the log of the performance of the vessel under sail alone, with the paddles removed. The paddles, though newly put on, and with copper bolts and nuts, required two hours to take off 11 in each wheel, the sea being smooth and the weather fine.

Performance under Sail alone, the paddle wheels being turned by steam only as fast as was necessary to prevent them from impeding the Vessel's speed.

For the sake of brevity, I have tabulated from the steam log of the vessel, all of her performance under the above conditions.

From the annexed table it will be seen that the means of 492 hours' performance under sail alone, with the paddle wheels turned by steam to prevent their dragging, were as follows, with ordinary sea, moderate breeze ranging from abeam to aft, all sail set, and vessel drawing 17 ft. 4 in. forward, and 18 ft. 8 in. aft; immersion of lower edge of paddles, 5 ft. 4 inches.

Speed of vessel per hour, ...	8·234 knots.
Steam pressure in boiler per square inch above atmosphere,	7·1 pounds.
Double strokes of piston per minute, ...	8·73
Steam cut off at from commencement of stroke, .	5 feet, or ½
Throttle open, ...	0·15
Number of furnaces in operation, ...	5
Consumption of bituminous coal per hour, . .	1797 pounds.
Consumption of bituminous coal per 24 hours, .	19¼ tons.
Excess of the vessel's speed over the speed of the centre of pressure of the paddles, ...	4½ per centum.

COST OF THE "SUSQUEHANNA."

Hull, ...	$310,933
Masts and spare spars, ...	8,936
Boats, ...	4,934
Rigging, ...	18,926
Sails and spare sails, ...	12,383
Tanks and casks, ...	4,595
Anchors and cables, ...	16,212
Furniture, ...	2,260
Miscellaneous, ...	1,810
Machinery, ...	324,681
Armament, three 10 inch guns, and six 9 inch guns,	4,738
Ordnance equipments and stores for three years,	20,240
Engineer's stores, ...	7,185
All other stores, ...	14,724
Total cost of vessel equipped and fitted for a three years' cruise, . .	$752,557

WEIGHTS OF THE SUSQUEHANNA.

Hull, (including wheel houses, guards, engine, keelsons, &c.,)	1704	tons.
Masts, rigging, and sails, ...	82	"
Boats, ...	9	"
Cables and anchors, ...	82	"
Armament, ...	97	"
Men, ...	35	"
Tanks, casks, water, and dunnage, ...	142	"
Provisions, ...	75	"
Various equipments, galley, furniture, &c., ...	20	"
Stores in various departments, ...	44	"
Total weights in steam department except coal, . . .	726	"
Coal in bunkers, ...	900	"
Total weights, ...	3916	"

For the Journal of the Franklin Institute.

On the Telegraphic Lines of the World. By DR. L. TURNBULL.

Continued from page 138.

FRANCE.

The French are inferior in telegraphic enterprise to most of the other European countries. In that country the telegraph is under the control of government officers, and all the government business is done by signals, understood by those only who are in the pay of the government; the tariff is too high, and but little use is made of it, as the existing government does not wish it brought into general use: this is much unlike the republicanism of the U. States. The principal instruments in use are those of Brèquet and Foy, which prints from 10 to 12 signs per minute; this is used along the railroad from Paris to Rouen. Wheatstone's needle telegraph and also the instruments of Dugardin and Gardiner are made use of. That of Brett is employed on the connecting line of England and France, between Dover and Calais, and Bain's Chemical Telegraph has more lately been introduced. The lines mostly originate in Paris, from which they stretch northward to Amiens, Arras, Valenciennes, Douae, Lille, Dunkirk, Calais, and Boulogne. South, they extend to Orleans, Louis,

əs, Angiers, Blois, Bourges, and Chateauroux; East, to Chalons, main; West, to Versailles, Rouen, Havre, and Dieppe: the whole being from 400 to 600 miles. Another line is about to be, or is l from Paris to Lyons. In last April, the government published ablishment of several offices on each line which could be used for correspondence; there were six of these points on the northern ıe same number on the southern, two on the western, and one on ıtern. The committee appointed for the purpose, recommended a l distribution of them on all the lines. The government have d the following tariff of charges, for a despatch of twenty words, ng the names of the sender:—

ım Paris to Arras,	4 f.	80 c.	From Paris to Angers,		5 f.	88 c.
" Valenciennes,	5	64	"	Bourges,	7	60
" Lille,	6	36	"	Nevers,	5	88
" Calais,	6	36	"	Chateauroux,	6	72
" Dunkirk,	7	56	"	Chalons,	6	24
" Orleans,	7	32	"	Rouen,	5	70
" Tours,	4	56	"	Havre,	5	76

əstimate the expense between each of these places, it is only neces find the difference of that between them and Paris respectively. spatches of more than twenty words, a fourth is to be added for ten words, so that this tariff will be double for sixty words.

.ve translated the following list of the lines of France, from the ə de Telegraphic Electrique," by Moigno, second edition, 1852.

Line of the North, from Paris to Valenciennes, by Amiens, Arras, , Lille, with a branch to Dunkirk, Calais, and Boulogne, 90 leagues.

Line of the South, from Paris to Chateauroux, by Orleans, Blois, Bourges, with a continuation to Bordeaux one way, and another ıtes.

The line of the East, from Paris to Chalons sur Marne, prolonged sburg, by Vetoy, Nancy, &c.

The line from Paris to Havre, by Rouen and Dieppe.

The line of Montereau to Troyes.

The line of Metz to Nancy, &c.

entire length of the finished lines form three hundred leagues, 750 English miles,) and according to Moigno, they have commit- irreparable fault of suppressing the old telegraphs.

Holland.

instrument used in Holland is a modification of Morse's by Mr. Robinson; this gentleman is an American; he has obtained the ge of erecting and managing lines of magnetic telegraph, in the Kingdoms of Norway and Sweden, for fifty years. A company of capitalists of this city and Stockholm, have commenced in the which is to begin immediately. A similar privilege is expected ıe Government of Denmark. Most of the Belgian and Holland ıd Companies have constructed telegraphs; there is one now in ion from Amsterdam to Rotterdam, and the Government of Holland thorized the construction of one from Amsterdam to the Helder, .e from Rotterdam to Vleissingin.

Italy.

Considerable progress has been made in the construction of lines throughout the Italian States. By virtue of an ordinance of the Minister of Public Works, the telegraphs which are to connect Rome on one side with Cevita Vecchia and the sea, and on the other side with the Austrian boundary at Ferrara, will be established at an early day.

Spain.

In Spain, the line from Aranjuez to Madrid is complete, and others are being laid down to Seville, Cadiz, Valenten, Barcelona, and the frontier of France. Before long there will be a general telegraphic communication from one extremity of Europe to the other, and when the connexion between Dover and Calais shall have been completed, the people of London will be able to communicate with those of nearly every capital on the continent, extending over a space of nearly 6000 miles.

Russia.

A Prussian engineer has gone to St. Petersburg, in order to establish electro-magnetic telegraphs throughout the whole Russian monarchy.

Mexico.

A contract has been entered into by the Mexican Government, with Wm. George Stewart, Esq., the Mexican Consul at New York, and Senor Juan de la Grariga, of Mexico, to construct a line from Vera Cruz to the City of Mexico, a distance of three hundred miles; one hundred and twenty of which, as far as El Oge de Argua, was to have been completed on the 1st of May, 1851. Another line will soon be built between Acapulco and the City of Mexico. When both are completed, there will be a magnetic communication between the Atlantic and Pacific.

A letter from Mexico informs us of the progress of the magnetic telegraph in that country. It appears that the party who went from the U. States to that country for the purpose of putting up a line of telegraph from the City of Mexico to Vera Cruz, have finished it from the former city to Napolucan, a distance of about 150 miles, and half way to Vera Cruz. The other half will be finished in two and a half months. The line already up is doing a very fair business; the receipts averaging $35 per day, and the expenses about $15. These receipts will be largely increased when the line is finished to Vera Cruz, as the largest portion of the business transactions of the country is between that City and the City of Mexico, including Puebla and Orizaba. Another line is in contemplation from the City of Mexico to Acapulco, on the Pacific, 300 miles further, which will connect the Atlantic and Pacific. This will be a highly important connexion, considering our California possessions on the Pacific.

Mexican advices to Sept. 4th, says: Sr. Don Juan de la Granja has finished the telegraphic line from Vera Cruz to Mexico, and is about to undertake the construction of another line from Mexico to Guanajuato.

Cuba.

The Governor General has ordered the publication of the concessions made to companies for the establishment of electric telegraphs through all points, and to the principal cities of Cuba. The lines will be established

from Villanueva to Union, crossing several small towns in their way; from Union to Matanzas; from Buerba to Macagua; from Tinguaro to Jucaro; from Navagas to Isabel; from San Felipe to Batabano, and from Rincon to Guanajay, by San Antonio. The companies will be obliged to commence the works six months after the date of the concession, and to establish them with the greatest possible activity.

The Cubaneras have discovered the benefits the magnetic telegraph confers by facilitating business and transmitting communications from one point to another. They are, therefore, setting about establishing telegraph lines throughout the Island. Two companies have been formed for this purpose. One of these companies, with a capital of $20,000, propose a line from Havana to Cienfuegos, passing through Isabel, Trinidad, and Manzanillo, to Cuba. From this point it will be extended to Bayams, and thence to Guanagos and Pinar del Rio, ending at San Juan and Martenez. The second line, which also starts from Havana, will communicate with Cardenas, Matanzas, Siena, Morena, Sagua la Grand, San Juan de los Remedios, Neuvitas, Moron, and Halguin, and will end at Cuba, having three branches to Puerto Principe, Sancto Spiritus, and Villa Clara. The same company propose a line from Havana to Hariel, Cubanas, and Bahia Honda; the capital of this company is $300,000. These lines, when completed, will connect the capital with every considerable town on the Island.

Valparaiso.

The telegraph between Valparaiso and Santiago, is progressing rapidly. Messages have already been sent over one-third of the line, (from Casa Blanca to this city.) From present appearances, the line will be through in less than forty days, as the poles are already up more than three-quarters of the distance.

India.

This all-infusing enterprise has aroused the lethargic inhabitants of the tropical climate. An electric telegraph has been erected in India, and is now in successful operation: the telegraph will soon belt both continents.

On the Influence of Sulphur upon the Nature of Cast Irons. By M. Janoyer, Director of the Blast Furnaces of Orme.*

In the present memoir I shall describe some experiments which I have made in order to ascertain the influence which sulphur exercises upon the nature of cast irons. All works on metallurgy, which have treated of the action of the simple non-metallic bodies upon cast iron, point out, it is true, the tendency of sulphurous ores to produce white metal in their treatment in the blast furnace, but not one gives any information respecting the mode of action of the sulphur. It is generally admitted that sulphur renders cast iron too fusible, and consequently difficult to convert into gray metal. This explanation, which has some truth in it, is not sufficient, seeing that very gray cast iron may be easily produced with highly *phosphorized,* and consequently very fusible ores. The disinte-

* From the London Chemical Gazette, June 15, 1852.

grated oolitic ores of Villebois and of Tremblois, which contain a large proportion of phosphorus, furnish tolerably good results. It is necessary to admit, independently of the great fusibility, some chemical action of the sulphur,—a decarbonizing action upon the iron.

The charge for the blast furnaces of Orme, situated in the coal basin of the Loire, consists essentially of two kinds of ores, viz:

Compact peroxidized ore of Privas.		Carbonated ore of the coal measures.	
Clay,	16·55	Clay,	73·15
Peroxide of iron,	70·05	Protoxide of iron,	37·02
Lime,	5·88	Sulphuret of iron,	5·98
Water and volatile substances,	7·52	Lime,	0·86
		Magnesia,	0·55
	100·00	Water and volatile matters,	42·00

The first is a compact ore, of an average degree of reducibility, and tolerably fusible; the second is both easily reducible and fusible, but it contains much sulphur; the gangue of both is argillaceous.

Of these two ores, that of the coal measures (especially when calcined,) presents, excepting the sulphur, all the conditions essential for gray cast iron with large and open grain; and to protect it from the great fusibility of the sulphurous cast irons, and preserve it from the action of the sulphur and silicon, which weaken the tenacity, I treated this ore with a large proportion of lime, in order to facilitate the formation of a sulphuret of calcium and a silicate of lime, and thus to get rid of these two injurious substances.

The first day, the blast-furnace working hot and very regularly, gave a very gray iron; but the nature of the product soon changed; the iron became porous (*truitée*), fibrous, white, and lastly cavernous, granular and white, although the working of the blast-furnace remained good and regular.

I had not to fear an incomplete reduction, owing to the great fusibility of the sulphuretted irons (fusion before reduction), for the corresponding slag was white, stony, and without a trace of protoxide of iron. There was no variation in the atmosphere; the blast applied preserved the same temperature and pressure; there was no alteration in the combustible, nothing, in fact, which would account for such a change in the product. I then attributed the change observed to a cooling of the lower part of the furnace, owing to the formation of the excessively basic slags which I sought to produce. Their analysis gave—

Silica,	34·50	
Alumina,	18·00	(without a trace of iron.)
Lime and magnesia,	47·00	
Sulphur,	0·13	
	99·63	

To obtain a less basic slag less difficult to fuse, I progressively diminished the amount of lime. The working of the furnace continued constantly hot and regular; but the iron, instead of improving, became more and more cold. On being run from the furnace, a loud decrepitation was audible, and it quickly solidified; on fracture, it was coarse and sometimes cavernous; it exhibited in every respect the character of a cast iron produced with a cold working, the carburation being imperfect, although the appearances

of the working, of the slag, the flame at the throat of the furnace, indicated the contrary. By diminishing the amount of flux without varying the other elements of the slag, I restored to the crucible the heat which might have been abstracted by the formation of too basic a slag; on the other hand, I isolated a larger amount of sulphur; the product became worse and worse, so that I was led to attribute to the sulphur alone the deterioration of the cast iron. I imagined that the whitening of the iron was due to the subtraction of a part of the carbon of the cast iron in the form of sulphuret of carbon, and to the heat rendered latent by the volatilization of this body. I then made various synthetical experiments, in order to prove this kind of action of the sulphur upon the carbon of the cast irons.

3 grms. of a beautiful large-grained gray iron were treated with *aqua regia*, and the solution mixed with chloride of barium; I obtained 0·02 sulphate of baryta = 0·0027 gr. sulphur, or 0.09 per cent. of the weight of the cast iron.

Knowing exactly the amount of sulphur, I re-smelted—

1. 32 grms. of this same metal with 0.64 of pyrites (bisulphuret of iron), perfectly crystalline and without gangue.

2. 40 grms. with 0·40 pyrites, to see whether this iron, after whitening, would contain more sulphur, and how much it would increase or diminish in proportion as the amount of pyrites was increased or diminished. When the material was fused and very liquid, I uncovered the crucible, and perceived some brilliant globules of a more intense white than the fused metal, which were disengaged between the sides of the crucible and the metallic button, and disappeared on contact with the air, producing at this spot a very perceptible lowering of the temperature. When the disengagement had ceased, I let the metal cool very slowly in the crucible in which it had been fused, to be certain that the whitening did not proceed from a too sudden cooling. Notwithstanding this precaution, the metal, which till then had remained tranquil with a smooth surface, opened in all directions, produced a loud decrepitation, and became covered with an uneven crust, which separated partly from the metal, and presented in every respect the characters of a granular iron produced by an imperfect carburation in a bad working. When broken, the cast irons were white, and the more so in proportion to the amount of pyrites. They were excessively hard; a file of cast steel would not act upon them.

I examined these white metals. 3 grms. of each were treated with *aqua regia*, and the solution mixed with chloride of barium. The first gave 0·19 grm. sulphate of baryta = 0·026 of sulphur = 0·87 per cent. of the weight of the metal. The second gave 0·10 sulphate of baryta = 0·0133 of sulphur = 0·46 per cent.

From these two assays, it will be seen that the cast iron contains, after this fusion, a greater proportion of sulphur, and that this proportion increases almost in the same relation as that of the pyrites added, since in the first case we find nearly twice as much sulphur as that given in the second experiment, which contained exactly half the amount of pyrites. This is what I expected in some measure, for the pyrites lose by heat the half of its sulphur on being changed into more stable protosulphuret, and the affinity of the sulphur for the iron would necessarily give rise to

the combination of the sulphur set free with the metal. The composition of the pyrites is—

Sulphur,	54·26
Iron,	45·74

An assay in the dry way, made with the mixture of 2 per cent. pyrites, contained before fusion 1·06 per cent. of sulphur; if the half, which was disengaged from the bisulphuret by heat, had combined entirely with the metal, I ought to have found the same amount of sulphur, whilst analysis only gave 0·87 per cent., from which must still be deducted 0·09 per cent. which the first cast iron contained, leaving 0·78 per cent. as the entire amount of sulphur which the metal took up in the fusion with pyrites. There was, therefore, a loss in this operation of 0.28 per cent. of sulphur.

The first experiment made with the mixture of 1 per cent. pyrites, which therefore contained before fusion 0·53 per cent. of sulphur, furnished only 0·46 per cent. of sulphur, from which must be subtracted, as in the first case, 0·09 per cent. contained in the metal, leaving 0·37 per cent. In this smelting there was, therefore, a loss of 0·16 per cent. of sulphur.

From the results of these two experiments, it is evident—1st, that the irons contain the more sulphur the larger the amount of pyrites present when they are re-smelted. 2d, that there is a loss of sulphur after complete fusion, and that this loss at a certain time is greater the larger the proportion of pyrites.

These facts once established, it is highly probable, if not certain, that this portion of the sulphur is lost by forming with the carbon of the irons volatile sulphuret of carbon, which produced the brilliant globules observed in the above experiments.

To arrive at a certain proof, I repeated comparatively the experiments previously made by M. Berthier upon a mixture of perfectly clean soft iron filings and pyrites. M. Berthier found, that, by fusing clean soft iron with pyrites, atom for atom, protosulphuret of iron is always formed without any *loss of sulphur*. If this were the case, it is proved that the sulphur lost in the preceding experiments, combined with the carbon of the irons, forming sulphuret of carbon, which had a decarburating action, and produced at the same time some latent caloric by its volatilization; for it is known that on evaporation this liquid produces a decrease of temperature capable of freezing mercury.

I made a first experiment by fusing in a naked crucible before the forge 20 grms. of soft iron filings, well cleansed, with 0·40, *i. e.* 2 per cent. of pyrites. To avoid a slight oxidation by the air which might have entered the crucible, I covered it with a piece of coke; and when the whole mass had arrived at a white welding heat, I uncovered the crucible to see whether in this case there was any liberation of brilliant globules, as in the fusion of the iron with 3 per cent. of pyrites; I could perceive none; the mass remained quiet, and when cold, presented the form of a tolerably compact, uniform button; on being broken, some rather dark yellowish-brown sulphuret of iron was apparent here and *there*, which was without a doubt protosulphuret disseminated throughout the mass. This first experiment I considered a proof of the forma-

tion of sulphuret of carbon by the fusion of gray iron in the presence of pyrites, as only in this case did I observe the liberation of brilliant globules.

I made a second experiment, in which I determined the amount of sulphur. 2·31 filings of well cleansed iron wire were fused with 2 per cent. of pyrites; I obtained a well-fused compact button, which was easily acted upon by the file. 1·05 was treated with nitro-muriatic acid; it dissolved slowly, but entirely; the solution was precipitated by chloride of barium, and I obtained 0·08 grm. sulphate of baryta, or =1·04 per cent. of sulphur, instead of 1·05 per cent., which the mixture must have contained before the fusion. I thence concluded, as M. Berthier had done, that in the fusion of clean soft iron with pyrites, there is never any loss of sulphur. Therefore, as I have stated at the commencement, we must not attribute to the too great fusibility alone the tendency which sulphurous ores have to yield white irons. The principal cause is due to the formation of a sulphuret of carbon, which acts by decarbonizing in part the metal, and by producing a considerable lowering of the temperature from the caloric rendered latent by the volatilization of this product.

I have stated above, that, on fusing gray metal with variable proportions of pyrites, it became deteriorated, and I have supported this statement by experiments. It remained to be seen whether the same would occur, if, instead of operating upon the cast iron, we were to take the ores. I therefore reduced 20 grms. of the Privas ore with 2 grms. of lime, the whole mixed with 2 per cent. of pyrites in a crucible lined with charcoal. The metal was allowed to cool very slowly in the crucible; but notwithstanding this precaution, the fracture of the button was entirely white, and exhibited in the portion in contact with the slag some yellow plates of sulphuret of iron. Throughout its thickness, it presented large cavities coated with filamentary crystallizations of sulphuret of iron. In the massive portions, the metal had a granular appearance. Altogether, it was very bad, exceedingly brittle, and exhibited not the least elasticity under the hammer.

20 grms. of the same piece of ore, reduced in a lined crucible with 2 grms. of lime and 1 per cent. of pyrites, likewise furnished a very white metal, although cooled very slowly. The button exhibited, like the preceding one, large cavities coated with filamentary crystallizations; the iron was bad and brittle, and without elasticity. The only difference was, that there were no yellow plates of sulphuret of iron perceptible at the junction of the metal and of the slag.

To be certain that, on treatment in the blast-furnace, the pyrites, or rather the sulphur of the pyrites, was an obstacle to the production of a gray metal, I treated 20 grms. of the same piece of ore which had served for the preceding experiments with the same amount of flux without any addition of pyrites. The metal obtained was gray, without, however, being graphitous; it yielded slightly to the hammer, was perfectly compact in the interior, and showed no sulphurous crystallizations. I was, however, able to distinguish with the aid of the lens some minute filaments of sulphuret of iron at the place of contact of the slag with the metal. On analysis, I obtained but a trace of sulphate of baryta.

I now proceeded to determine the amount of sulphur in the metal obtained in the two first experiments, by reducing the ore in the presence of pyrites, in order to see whether also, in this case, acting upon the ores and not on the metal, the latter would contain an amount of sulphur greater in proportion to the quantity of pyrites present. The experiment which had been made with the mixture of 2 per cent. of pyrites furnished, on the analysis of 1 grm., 0·07 sulphate of baryta=0·96 per cent. of sulphur. As the mixture contained previous to fusion 1·06 per cent., we have a loss of 0·10 per cent.

1 grm. of the metal obtained in the experiment made with 1 per cent. of pyrites furnished 0·03 grm. sulphate of baryta =0·41 per cent. of sulphur; since the mixture contained 0·63 per cent. of sulphur, we here again meet with a loss of 0·12 per cent.

It is evident, from these experiments, that the metals contain the more sulphur the more the ores from which they are produced contained pyrites, the proportion of flux remaining invariable.

In order to prevent the injurious influence of the sulphur upon the iron in the treatment of pyritous ores in the blast-furnace, I increased progressively the amount of flux; for, according to M. Berthier, the lime decomposes a considerable quantity of sulphuret of iron at a high temperature in the presence of carbon. In order not to interfere with the fusibility of the slag, I first of all endeavored to ascertain the maximum quantity of lime it might contain. By fusing together the clay and the lime, experiment led me to the following composition as the limit which should not be exceeded:

Silica, ...	36·00
Alumina, ...	10·00
Lime, ...	54·00

Having made this experiment, I obtained, by adding gradually lime to the charge of the blast furnace, a white stony slag containing not a trace of oxide of iron, and approaching closely to the above composition; there were here and there particles of uncombined lime mechanically intermixed. The working of the blast-furnace was constantly good and regular, the combustible very good, and the blast heated to 750°, so as to restore the heat abstracted by this enormous amount of lime.

Notwithstanding this maximum amount of flux added to the charge, I was not able to prevent the action of the sulphur; and to obtain good *gray* metal, it was necessary to subtract a large quantity of the highly pyritous ores of the coal measures.

I next proceeded to ascertain what became of the sulphur on effecting the reduction in lined crucibles. I took:—I. 10 grms. of the ore from Privas, 5 grms. of the slag from the blast-furnace, 5 grms. of lime, and 0·20 of iron pyrites. II. 10 grms. of the ore from Privas, 5 grms. of slag, 10 grms. of lime, and 0·20 of iron pyrites.

The two experiments succeeded perfectly. The first gave a well-fused, vitreous, bright gray slag. However, throughout the portion of the slag which surrounded the button, a hard, whitish-yellow, compact substance, with a smooth fracture, was disseminated. The button of metal was quite white, with a very irregular fracture, very cavernous, and exhibiting a few filaments of a sulphurous crystallization. Three

ittle balls of metal, which did not adhere to the button, but rested above he slag, had escaped the decarbonizing action of the sulphur; for with a ens, and even with the naked eye, several large laminæ of graphite were erceptible, and the metal was perfectly black. The mixture of the ore, ime, and pyrites not having been perfect, a small quantity of the ore ad been reduced, protected from the action of the sulphur, which, on he contrary, had strongly acted upon the button of metal. On anaysis, 1 grm. of this white iron gave 0·009 sulphate of baryta = 0·1242 er cent. of sulphur.

The second experiment, in which there was double the amount of lux—the maximum quantity of the fusibility of the slag,—furnished a rayish-white slag filled pretty uniformly with the yellowish-white subtance, which in the previous experiment had occurred here and there lisseminated in the scoria; it had a shining yellow appearance, and when xposed to moist air, fell for the greater part into a powder, and furnishd an enormous quantity of quick-lime. Notwithstanding the powerful ffinity which this large amount of lime must have presented for the sulhur, the metal was entirely white, with a granular cavernous appearnce, but exhibited no trace of a sulphurous crystallization; it was much nore malleable than that obtained in the preceding experiment; it was ather difficult to reduce to powder, and in the mortar flattened out. Although white, it was easy to observe that there was a great improvenent in its tenacity. I grm. of this whitish metal gave 0·005 sulphate f baryta = 0·069 per cent. of sulphur, which is scarcely more than half he quantity found in the preceding experiment.

From these two conclusive experiments it is seen, that the amount of ulphur in cast iron diminishes in proportion as the amount of lime conined in the slag increases, but that it is impossible, in certain cases, to emove it altogether without rendering the slag infusible. I have stated, n speaking of the experiment made by fusing 10 grms. of the Privas ore, grms. of slag, 5 grms. of lime, and 0·20 pyrites, that the slag which urrounded the button was altogether compact and yellowish-white, whilst the rest of the scoria was vitreous, and showed nothing similar. The analysis of this portion proves, from the presence of the large amount f sulphur, that some sulphuret of calcium is mixed with the slag; and om its being in immediate contact with the whitened metal, it is evident hat the sulphuret of calcium has been formed by some sulphurous emaations from the metal. This slag had the following composition:—

Silica,	40·07
Oxide of iron and alumina,	15·00
Lime,	43·75
Sulphur,	0·50

On comparing the result obtained in the analysis which gave 0·069 er cent. of the weight of the metal with the sulphur previously found n a very gray metal (0·09 per cent.), it is quite evident that the whitenng must not be attributed to the sulphur combined with the iron,—sulhur which might form a true sulphocarburet of iron, and prevent the solation of the graphite. It is owing to the loss of sulphur,—as shown y the two experiments made by fusing at first gray metal, and subseuently clean soft iron with pyrites,—which combines with the carbon,

forming very volatile sulphuret of carbon, and rendering a large amount of caloric latent. Hence we have the whitening produced by two simultaneous actions,—subtraction of a portion of the carbon of the cast irons, and lowering of the temperature from the volatilization of the sulphuret of carbon.

With respect to the position in which the sulphuret of carbon is formed in the blast-furnace, it may be admitted that it is produced wherever the temperature is at a red heat, bearing in mind that Lampadius detected sulphuret of carbon by heating to redness some pyrites and charcoal, and that these conditions occur in the blast-furnace. On the other hand, the analyses of the gases by M. Ebelmen, have not shown its presence, although the latter assumes that probably the sulphur exists in the gases in the sulphuret of carbon, but in inappreciable proportion. We must, therefore, attribute its absence to the highly reductive properties which the sulphuret of carbon possesses, which could not exist in the presence of oxide of iron. In proportion as it was formed, it would be decomposed into sulphuret of iron and oxide of carbon.

It is also possible that the pyrites, on losing the half of its sulphur by heat, yields it to the iron already reduced, converting it into protosulphuret without the formation of any sulphuret of carbon, and we arrive at the same result, that is, the conversion of the iron into protosulphuret in its progress through the furnace.

The flux not having lost the whole of its carbonic acid, does not possess sufficient affinity for the sulphur to decompose the protosulphuret of iron which is constantly being formed. It is only in the neighborhood of the *tuyères*, when the flux has been entirely changed into caustic lime and partially into calcium, that the affinity of the carbon in a nascent state (graphite), together with that of the lime for the sulphur, determines the decomposition of a part of the protosulphuret of iron. There is then formed sulphuret of carbon at the expense of the carbon of the cast iron, and caloric thereby rendered latent. Another portion of the sulphur combines with the calcium.

The sulphuret of carbon formed in the crucible itself, must be again partially burnt by the blast, from which would result sulphurous and carbonic acids, which would reproduce some sulphuret of iron and calcium, and oxide of carbon; and it should be remarked here, that the proportion of sulphuret of calcium will be the more considerable the greater the amount of lime present in the charge. It follows, from this, that in order to obtain a metal which shall contain the minimum amount of sulphur, it is necessary that the slags should contain the maximum amount of lime. I may also add, that in this case the working of the furnace should be as hot as possible, in order to facilitate the isolation of the graphite, and consequently the formation of the sulphuret of carbon, which serves to transfer the sulphur from the metal to the slag.

The author observes, in conclusion, that a considerable improvement has recently been effected in the working of the blast-furnaces and their products by washing the coals, which removes a great portion of the pyrites, and also, by getting rid of the earthy matters, increases the heating power of the coal.—*Annalen des Mines*, Feb. 1852.

For the Journal of the Franklin Institute.

Steamboat Accidents. Loss of the Henry Clay—The Atlantic—The Reindeer.

The reckless mismanagement of steam boilers, which is so constant and just cause of reproach to our country, has been, within the last few weeks, more than usually destructive of life and property. During the earlier months of the year, it was with some trouble that we could keep the run of such accidents on the Mississippi and its tributaries; but it was with an unusual shock that we heard of the first of the accidents to which we intend particularly to refer, in consequence of its taking place on the Eastern waters, which have been comparatively free from such occurrences. The completion of the New York and Albany Railroad, running along the North river, rendered it apparently requisite that unusual efforts should be made by the steamboat proprietors to maintain their popularity, and numerous projects were spoken of, which clearly pointed to fatal results; but up to the 28th July, the railroad had enjoyed a monopoly of accidents, which had been of such frequency as apparently to justify some of our daily papers in keeping the heading, "Accident on the Hudson River Railroad," and similar ones for the Erie and the New Haven roads, in stereotype form. But on the day above mentioned, the steamboat *Henry Clay* was burned on the river, and the event being attended with such a fearful loss of life, as to draw much more than the usual attention to the circumstances, the result has been, to show a want of attention to the safety of the passengers, both in the planning and the management of the boat, which is as disgraceful as it is surprising. The circumstances, as we gather them from the evidence given at the Coroner's inquest, are as follows:—It appears that the *Henry Clay*, which was built to be the "crack" boat, started from Albany at the same time with the *Armenia*, a slower boat, and it soon became evident to those on board, that strong endeavors were made to get and maintain the lead, each of the boats, in turn, passing landings, where the other was engaged in discharging and taking passengers. At length, in a narrow channel of the river, the boats came in contact, not in such a way as to do any great damage, but exciting serious alarm among the passengers, which were crowded upon the *Henry Clay*. To their remonstrances, the officers of the boat, (the Captain, it appears, was sick, and in his state-room,) answered indifferently and impertinently, or answered not at all. The effect of the collision, however, was to cause the *Armenia* to drop astern, and the *Henry Clay* then took and maintained the lead, increasing the distance between them, until about 15 minutes past 3 o'clock, P. M., when the boat was discovered to be on fire, and a feeble and ineffectual attempt having been made to extinguish the fire, the boat was run ashore, below the village of Yonkers, and such of the passengers as could, escaped. After the alarm of fire was given, it does not appear that any effort whatever was made on the part of any officer of the boat to protect the lives of the passengers, or to give any orders by which the panic, so natural on such an occasion, might be avoided or allayed. The fire appears to have originated in the furnace-room, which

is amidships in the hold, and the dense smoke and intense heat soon cut off all communication between the forward and after parts of the boat. The greater part of the passengers, especially the women and children, were, as usual, aft, and the boat being run ashore bows on, (apparently for the especial benefit of the officers, who were in that part of the boat,) those in the rear of the engine were at a distance of some two hundred feet from the shore, and were obliged to commit themselves to the water, which is here deep almost to the very shore, many of them keeping on the wreck until absolutely forced over by the approach of the fire, which burned very rapidly. In this lamentable way, not less than eighty-one persons met their death. The occurrence of the accident on a favorite boat, and in the height of the traveling season, caused its immediate effects to be widely spread throughout our land, and increased the severity of the loss by the destruction of many most valuable lives; among which we especially grieve to record those of Mr. Downing and Mrs. Anne Hill. The loss of these will be more deeply felt, since they have left no one to succeed them in the lines of usefulness to which they had devoted themselves. Mr. Downing's reputation as a landscape gardener was known as well in Europe as here; his labors at Washington and in the vicinity of New York, by introducing a correct taste for the beauties of natural scenery, were invaluable to us, especially because they were directed to the production of results in which we have been heretofore sadly deficient. The same thing is true of Mrs. Hill, who was the Principal of the School of Design for Women, attached to the Franklin Institute. Her sex, her modesty, and the comparatively narrow sphere of her labors, prevented her from being so widely known; but the combination of so many talents, such energy and zeal, with all those virtues and delicacy which characterize a woman, ensured to her the warmest feelings of respect and attachment from those whose good fortune it was to know her. Like Mr. Downing, her tastes led her to the cultivation of arts to which heretofore but little attention has been paid among us, and her loss has left a vacancy which cannot for a long time be filled. The pain at losing such friends is aggravated by the reflection, that they were victims to the recklessness and incapacity of those whose duty it was to sacrifice, if necessary, their own lives for the preservation of their passengers; but we hope that the deep and wide-spread grief will prevent the public indignation from being as ephemeral as is usual in such cases.

As to the immediate cause of the accident, with which the majority of our readers will perhaps think we have most to do, there are many conjectures. It does not appear that any extraordinary effort on the part of the *Henry Clay* was necessary to outstrip the *Armenia;* and it is stated that the time of her trip from Albany gives an average speed of but 16 miles an hour, which is certainly far below her powers. But several of the passengers testified before the Coroner to the unusual heat about her engines, and to peculiar odors, as if from burning highly combustible materials, in the earlier part of the trip. The most probable suggestion which we have heard is as follows: It seems that it is customary with North River boats, on their downward trips, to feed their furnaces off Yonkers for the last time. The furnaces of the *Henry Clay* are in the hold of the vessel, and not on the guards, as usual. The use of anthracite as

fuel requires the blower, and it appears to be well known that when the blast is turned in, it is very apt to force open the fire doors, unless they are very carefully secured. If then we suppose that the fireman had not securely fastened the door after firing, and that the blast drove it open, we should have a powerful jet of flame poured out, as from a gigantic blow-pipe, on the wood work of the fire room, which from continual roasting is very combustible, and the light frame of the boat would catch and burn with almost incalculable rapidity. Such appears to us the most plausible account of the origin of the fire.

In connexion with the presence of one of the owners on board the boat, we give a singular statement from a newspaper, of what has since occurred on the same river. On this occasion there was a race and a collision, and one of the passengers having remonstrated with the Captain thereupon, the Captain told him that *he could not help it; that the son of the owner was on board, and was with the pilot; and that he* (the Captain) *had no authority to direct.* This statement seems to have attracted no notice, but it is really deserving of it, for if true, it points out a state of affairs which would render steamboat traveling almost suicidal.

On the 20th of August, the steamer *Atlantic*, from Buffalo to Detroit, with about 110 cabin passengers, and 270 deck and steerage passengers, and a crew of about 40 men, when off Long Point, (Canada,) and about four miles from the Light House, at 2½ o'clock, A. M., was run into by the propeller *Ogdensburg*, and sank in about fifteen minutes. The loss of life is uncertain, but is estimated at about 200. In consequence of the coolness and presence of mind of the officers, and an efficient provision of life-preserving furniture, the principal portion of the cabin passengers were saved. But the mass of the steerage passengers were Norwegian emigrants, unable to understand what was said to them, and among these the loss of life was fearful. The investigation of the Coroner's jury shews that the lights of the steamer were seen by the watch on board the propeller in time to avoid the accident, and inculpates the mate of the *Ogdensburg*, who will probably be arrested and tried, when we shall report the facts of the case, so far as they are developed.

On Saturday, the 4th of September, the *Reindeer*, another crack North River boat, (which it is said the *Henry Clay* was built expressly to beat, and which had been withdrawn during that unfortunate boat's short life, and returned to her usual trips since her destruction,) burst her boiler as she started from Kingston Point. The part which gave way was the connexion of the return flues, and by the escape of steam 32 persons were killed, and a large number badly scalded. The testimony before the Coroner's jury, shews one of those defects in the iron, which the most careful inspection cannot avoid, and the phenomena of the explosion do not require us to believe that there was any undue pressure of steam in the boiler. The occurrence of the accident immediately after starting the boat, looks as though there were a deficiency of water in the boiler, but the testimony on this point is strong to the contrary. Among the victims of this accident, we regret to record the name of Mr. Woods Baker, an assistant on the Coast Survey, a young gentleman who had distinguished himself by high abilities and zeal in performing his duties, while his amiable character

had endeared him to his many friends. It is a somewhat strange coincidence, that he should have perished in a way so similar to that by which his intimate friend and associate, Mr. Joel B. Reynolds, lost his life, by the explosion of the boiler at Morris' foundry in this City.

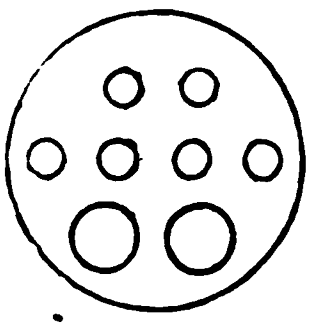
We shall publish the law recently passed by Congress, for the regulation of steamboats, and sincerely trust that its strict enforcement may prevent the necessity of such painful records in future.

EDITOR.

Since writing the above, we have received the following private letter from a friend, who is an entirely competent judge of the matter:

"Though competent witnesses have testified to their belief that the accident was due to defective iron, yet I am persuaded, from what I myself saw, that the true cause of the explosion was probably low water and heated internal flues.

There were six large internal return flues, each about a foot in diameter, and arranged thus:



The diameter of the boiler appeared to me to be not more than eight feet, perhaps less. The depth of water over the two upper flues must have been at all times slight, perhaps not more than two or three inches. It appears highly probable, therefore, that the gauge cocks may have given deceptive results, owing to foam; that the water level fell below the tops of the flues; and, therefore, the explosion while the boat remained at the wharf—the defective iron giving way because it was the weakest point."

Electric Property of Flame. By Prof. H. BUFF.*

The following conclusions are drawn from the experiments described by Prof. Buff:

1. Gaseous bodies which have been rendered conductible by strong heating, are capable of exciting other conductors, solid as well as gaseous, electrically.

2. When a thermo-electric circuit is formed of air, hydrogen, or carburetted hydrogen, alcohol vapor, charcoal, or finally a metal, whether combustible or incombustible, an electric current is developed, which proceeds from the hottest place of contact through the air to the less warm place.

3. The development of electricity which has been observed in process of combustion, and particularly in flame, is due to thermo-electric excitation, and stands in no immediate connexion with the chemical process.

4. The products of combustion do not therefore by any means occupy the relation to the burning body which has been assumed by Pouillet; if positive electricity rises with the ascending gases, it is only in the degree in which the burning body and the air exterior to the place of combustion, or rather exterior to the place of hottest contact, are connected by a proper conductor.—*Annalen der Chemie und Pharm.*, vol. lxxx. s. 1.

* From the Lond., Edinb., and Dublin Philosoph. Magazine, February, 1852.

On the Manufacture of Gas from Wood. By Dr. PETTENKOFER.*

Two years ago, Dr. Pettenkofer showed by experiment, at a meeting of the Polytechnic Institute of Bavaria, that a very considerable amount of illuminating gas could be disengaged from 2 oz. of wood. Its practicability on a large scale has since been the subject of much doubt. The inventor's process is now in operation at Basle, and it is also about to be introduced at Zurich, Stockholm, and Drontheim. The process is said to be far less expensive than the manufacture from fossil-coal, and furnishes a gas which is free from sulphuretted hydrogen, and several useful collateral products, as charcoal, wood-tar, and wood-vinegar.—*Central Blatt., March* 10, 1852.

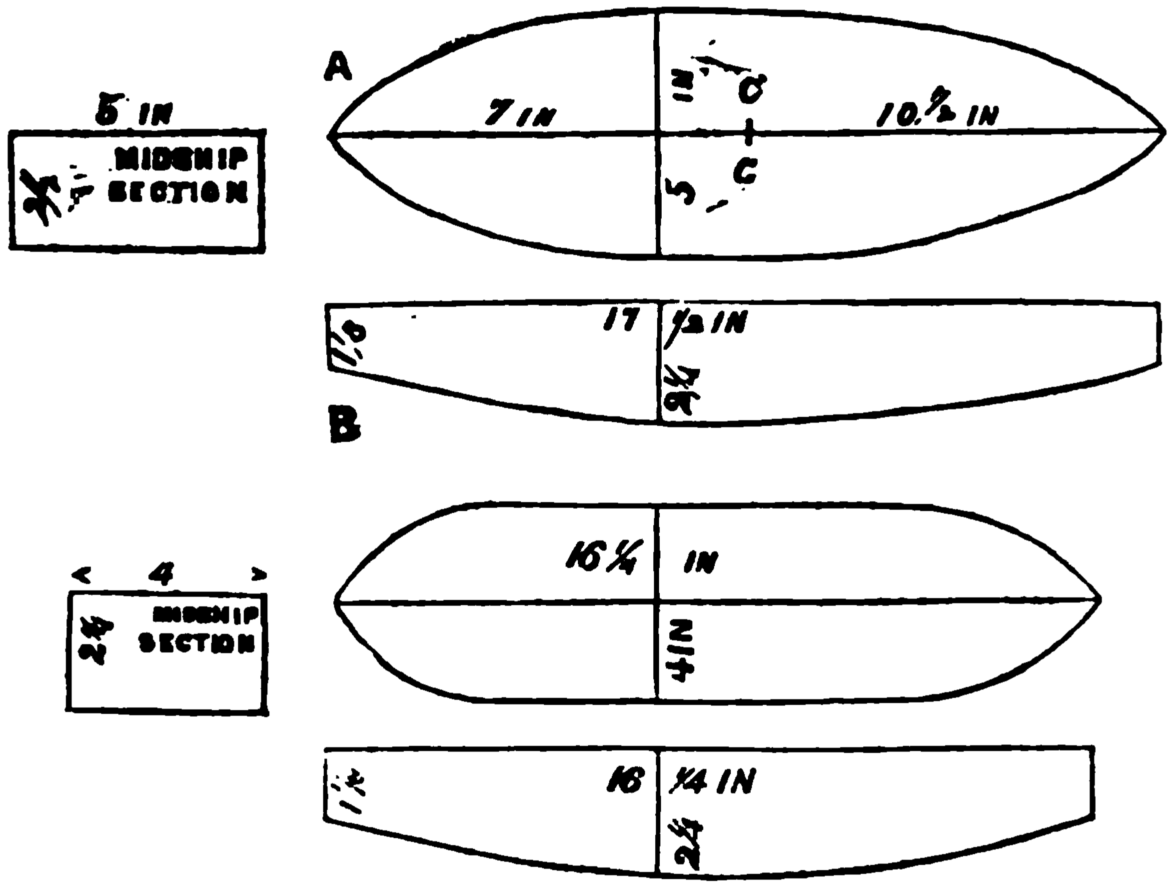
Hints on the Principles which should regulate the Forms of Boats and Ships; derived from original Experiments. By MR. WILLIAM BLAND, *of Sittingbourne, Kent.*†

Continued from page 182.

Having terminated the experiments relating to the midship section, and lee-way or lateral resistance, it will not be departing from the subject in view, to introduce in this place a few examples of floating bodies varied in their dimensions, and comparing their respective speeds.

First.

Diagram A, a boat, 5 inches wide, 17½ inches long, having curvilinear sides; weight, 25 oz.; compared in speed with B, a boat 4 inches wide, 16¼ inches long, with parallel sides; weight, 25 oz. Both these boats had their bottoms curved upwards from their midship sections to their load water lines.



Experiment 63.—The boat A, beat B, in speed by 6 oz. additional

* From the London Chemical Gazette, May, 1852.

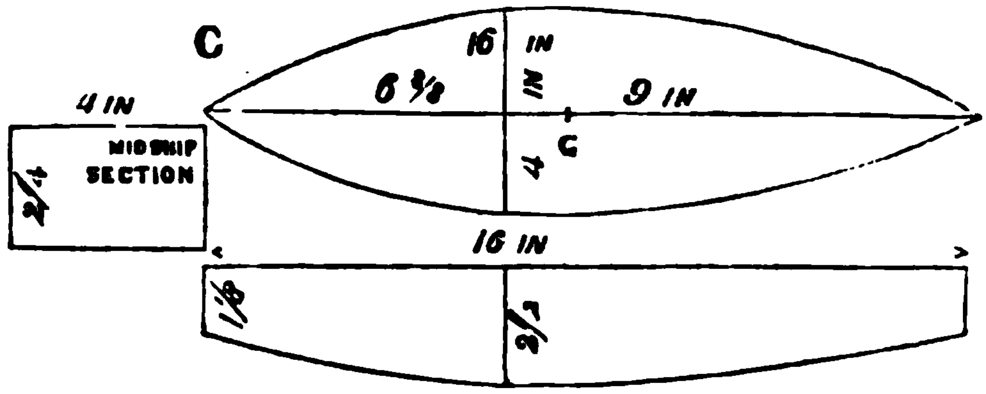
† From the London Civil Engineer and Architect's Journal, October, 1851.

weight: that is to say, to cause the speed of both to be equal under the same drawing force. The stability of A, equalled 5 oz.; that of B, 3 oz.

Second.

Experiment 64.—The boat A, compared in speed with a boat C, after the form of a bird, being 4 inches wide at midship, 16 inches long, having its bottom curved up the same as A, and of equal weight, being 25 oz. The boats, A and C, were equal in speed. The stability of A equalled 5 oz.; that of C, 2 oz.

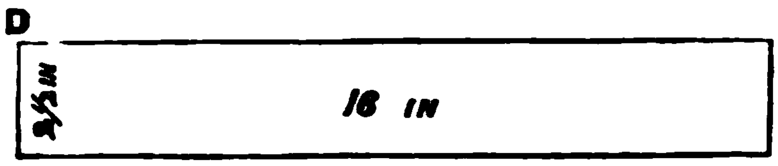
Experiment. 65.—But when C had the angles between the bottom and



sides removed and smoothed down, C then beat A by 4 oz. extra weight. But the stability was, in consequence, reduced from 2 oz. to 1¾ oz.

Third.

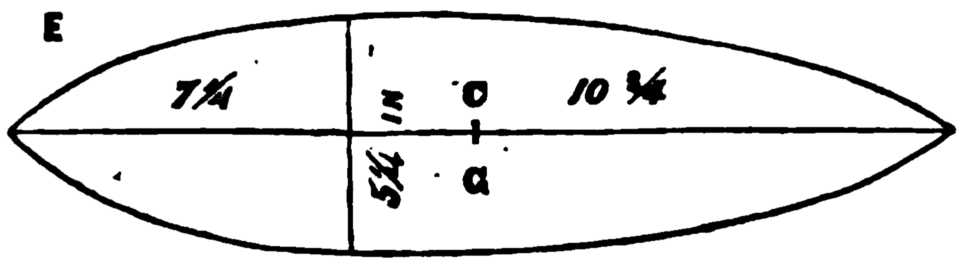
Experiment 66.—The boat C, was compared in speed with a boat of the precise form, but with the bottom not cut up, being left flat as in the



diagram, D. The weights equal, and being in this instance 22 oz. The boat C, beat D, by 12 oz. extra weight. Stability of C equalled 2 oz.; and that of D, 2 oz.

Fourth.

Experiment 67.—The boat A, was tested in speed with a boat E, 5¼ inches wide, 18 inches long, with curved sides, and bottom curved the



same as A. Their weights being first made to correspond, the trial upon the water gave their speeds equal. The stability of E, was 5¼ oz.

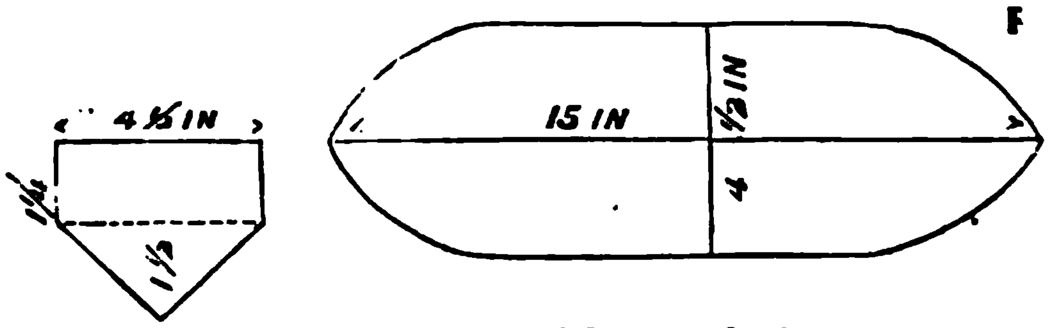
Experiment 68.—Upon the removal of the lower angles of the boat E, and making all smooth, its speed was improved 4 oz., so that it beat A, by the sum of 4 oz.

Fifth.

Experiment 69.—The parallel sided boat B, being tested against a parallel sided boat F, with triangular form of midship section, in width 4½ inches, and in length 15 inches, with the weight of each 21½ oz.; the form of bows the same. Being attached to the two arms of the balance rod, and drawn through the water, the result gave 4 oz. in favor of B,

that is, the additional weight of 4 oz. was put into B, which then rendered their speeds equal.

F

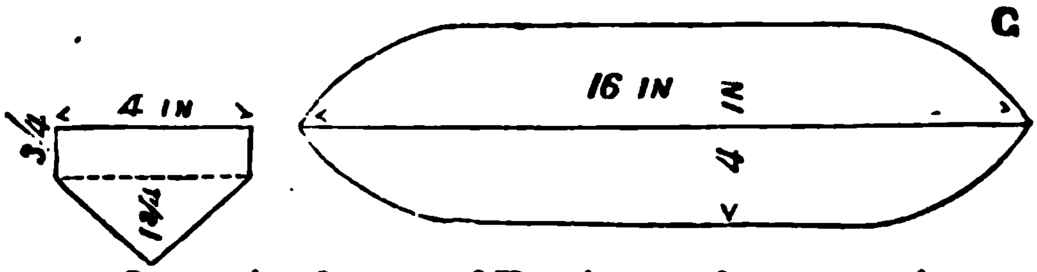


This was not a fair trial, F being wider and shorter than B. The stability of F, equalled $2\frac{1}{2}$ oz.

Sixth.

Experiment 70.—The boat B, was again tested with another boat, G, the midship section being a triangle; the length and breadth the same as B, and weight equal, being $21\frac{1}{2}$ oz., and having the bows of the same form.

G

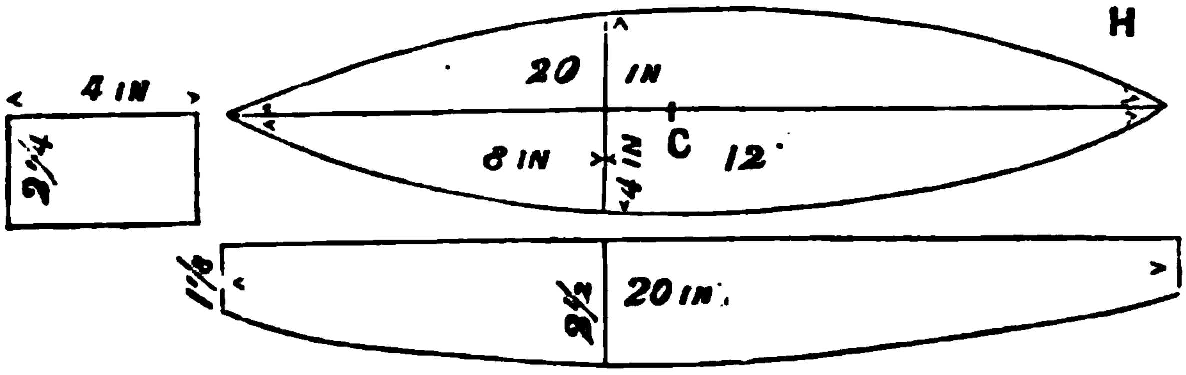


The trial gave 8 oz. in favor of B, since the superior speed of B required that weight extra to retard it to an equality with G. The stability of G, equalled $1\frac{1}{4}$ oz. The boat B, drew $\frac{7}{8}$-inch water at midship; F, drew $\frac{3}{4}$-inch; and G, drew $\frac{7}{8}$-inch; the respective weight of each being the same.

Seventh.

Experiment 71.—The boat C, being compared in speed with a boat H, of the same weight, and width of 4 inches; but in length 20 inches, having the bottom curved up as C.

H

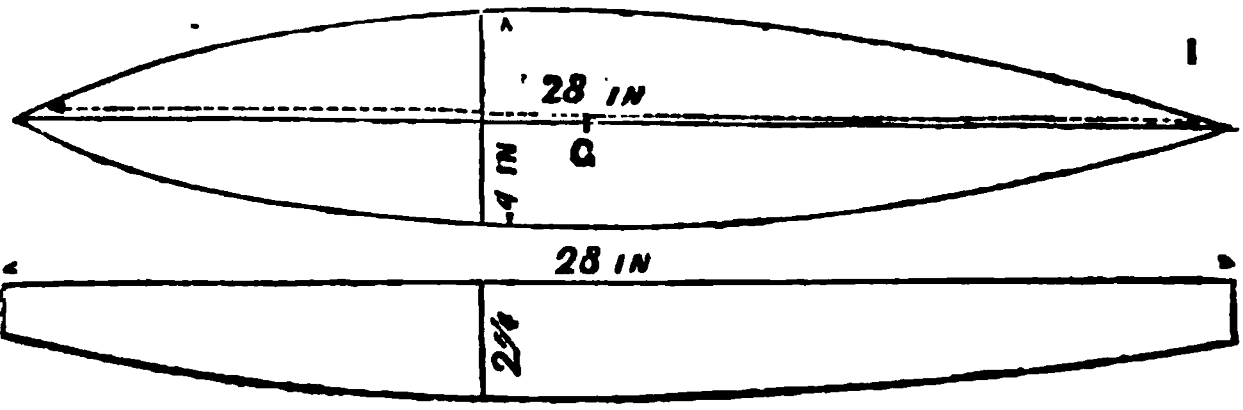


The boat H, beat the boat C, by 12 oz.; H, requiring that additional weight to equalize their speed. The stability of H, was $2\frac{1}{4}$ oz.

Eighth.

Experiment 72.—The boat H, was compared in speed with a boat I,

I



of the same weight, namely, 33 oz., and width of 4 inches, but 28 inches long, having the bottom curved as H.

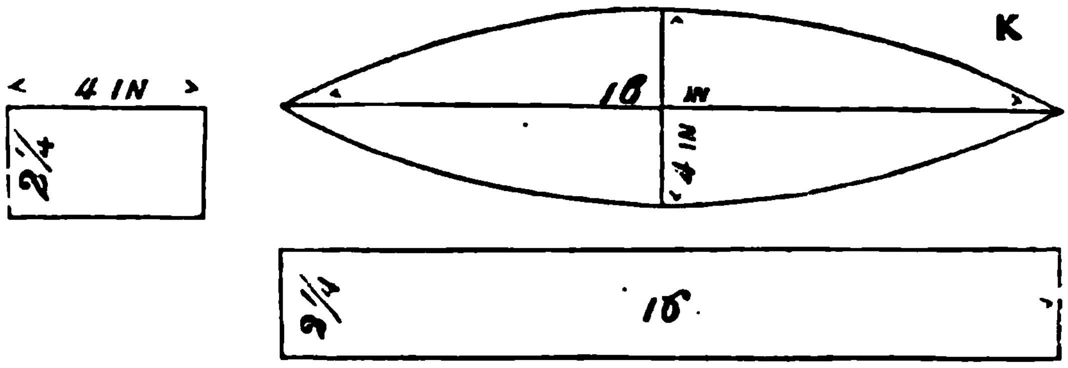
The trial gave the speed on the side of the boat I, and equal in weight to 24 oz. extra. The stability of I, was 2¼ oz.

Ninth.

Experiment 73.—The boat I, beat the boat E, before the angles were removed, by 32 oz. The stability of I, was 2½ oz., and that of E, 5¼ oz.

Tenth.

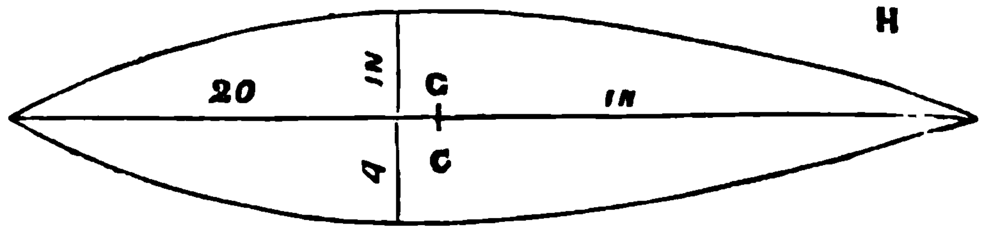
Experiment 74.—A boat K, 4 inches wide, and 16 inches long, having the midship section at the point of half its length, with the bows and stern alike, was tested against the boat C, but with bottom not curved up. The weight of each 20½ oz.

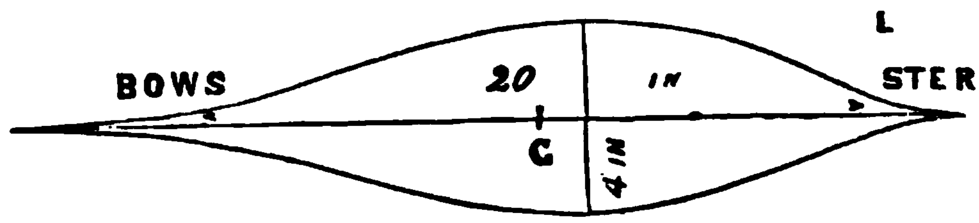


The boat K, beat in speed the boat C, by 2 oz., but its course through the water was much inferior to C; therefore, a piece of keel was necessary to remedy the evil. The stability of K, equalled 2¼ oz., that of C, 2 oz.

Eleventh.

Experiment 75.—The bird-shaped boat, H, being 20 inches long, and 4 inches wide, but not curved at the bottom towards each end, being quite straight, was tested against a boat of the form marked L; the length, width, and weight, the same as H, which equalled 22 oz.





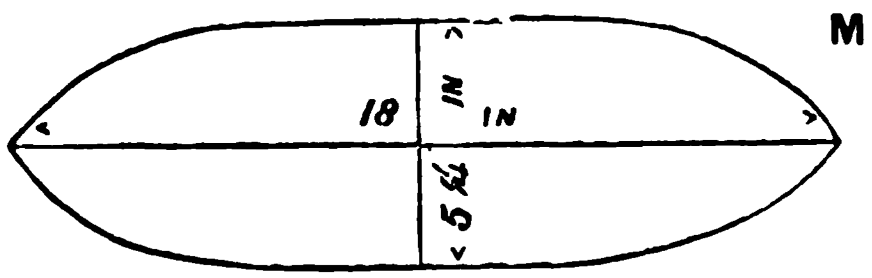
The trial of these two boats gave the speed on the side of H, with its bottom not curved, and to the amount of 4 oz. in extra weight, when the boat L, was drawn with its stern foremost; but when tested with its bows foremost, no difference was perceptible between them in speed. The stability of H, was 2¼ oz.; that of L, 1¼ oz.

Experiment 76.—On comparing the speed of H, with its bottom curved up, with the boat L, the difference was 12 oz. on the side of H, it being so far superior to L.

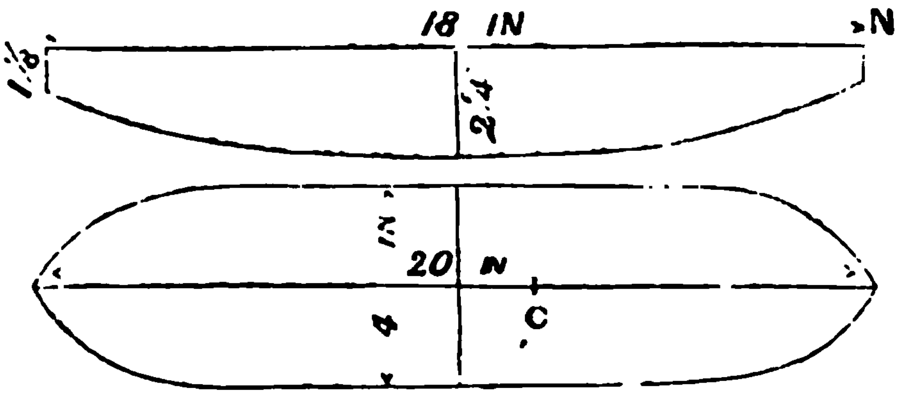
Twelfth.

Experiment 77.—Two boats, one of them, M, after the form of E, being 18 inches long, a trifle more than 5¼ inches wide, and which width was in this instance situated at the mid-length, with the bottom curved up to

the load-water line, commencing from the middle length, and terminating at each extremity; weight, 2½ lbs. The other boat, N, 20 inches long,



and a trifle more than 4 inches wide, sides parallel, but the bows the same in both, weight equal to M. This boat was also curved up from the mid length to each extremity.

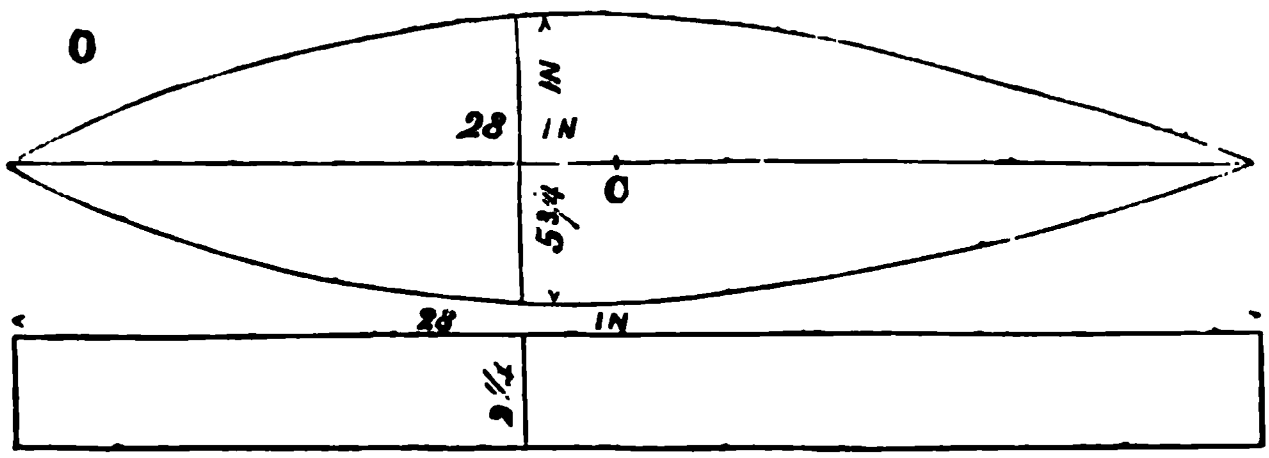


The result, upon trial, gave the speed 3 oz. superior on the side of M. The stability of M, equalled 6 oz.; that of N, 4 oz.

Experiment 78.—When the boat H was tested with the parallel sided boat N, their respective weights being 2 lb. 7 oz., the boat H, beat the boat N, in speed by the extra weight of 16 oz. The stability of H, equalled 2¼ oz.; that of N, 4 oz.

Thirteenth.

Experiment 79.—A boat O, of the bird shape, 5¾ inches wide, 28 inches long, weight, 2 lb. 5 oz., was tested in its speed against a boat also of the bird shape, 4 inches wide, 28 inches long; weight, 2 lb. 5 oz., and denoted in the preceding diagrams by the letter I. I, sank in the water $\frac{15}{16}$-inch, and O sank $\frac{11}{16}$-inch.

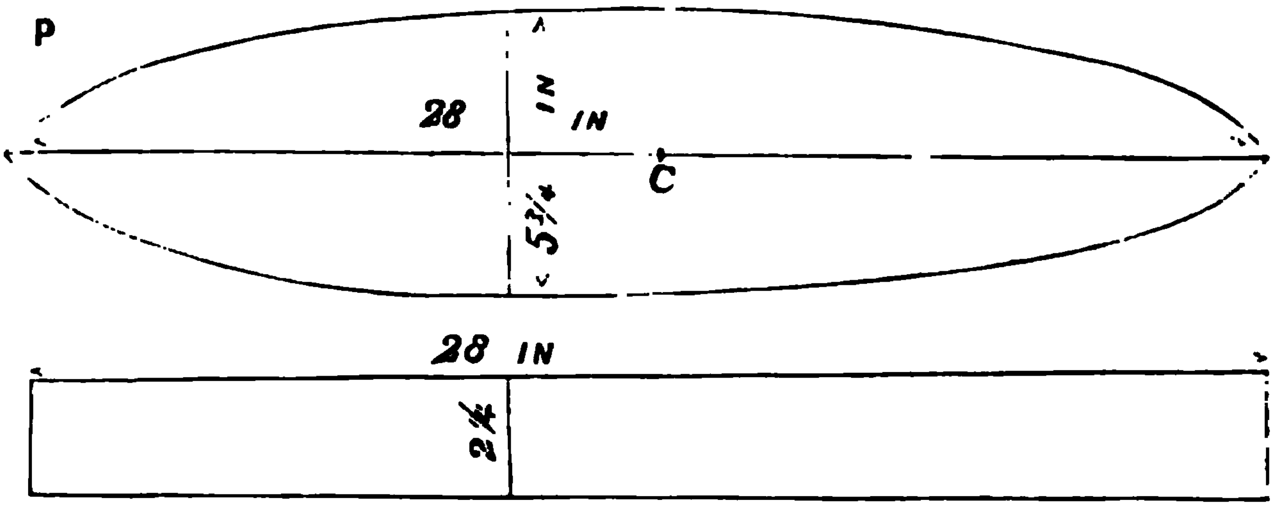


The result gave the speed on the side of I, in the extra weight of 12 oz. The stability of O, was 8 oz.; that of I, 2½ oz.

Fourteenth.

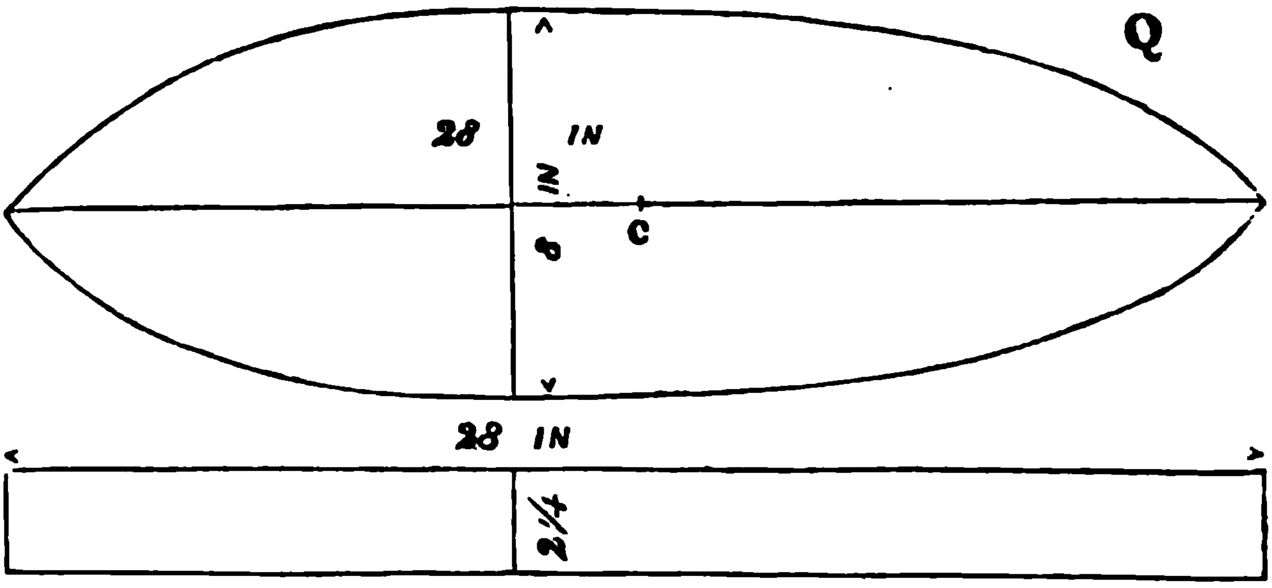
Experiment 80.—The boat O, was tested with a boat P, of a different form, but of the same width of 5¾ inches, 28 inches long; and weight of each, 3 lb. 4 oz. O, sank in the water $\frac{15}{16}$-inch; and P sank ¾-inch.

The boat O beat P, by 2 lb. 5 oz. extra weight. The stability of O, equalled $8\frac{1}{2}$ oz.; that of P, 12 oz.



Fifteenth.

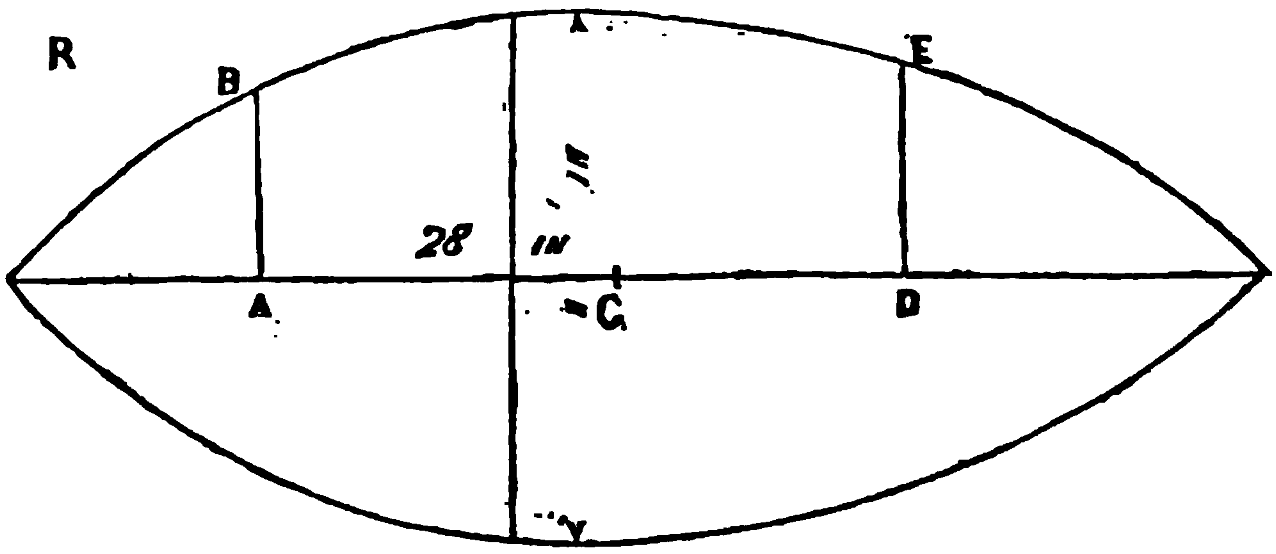
Experiment 81.—The boat P was tested against the boat Q, being 8 inches wide, 28 inches long, and weight of each, 3 lb. 4 oz. P, sank in the water $\frac{6}{8}$-inch; and Q sank $\frac{5}{8}$th-inch.



The boat P beat Q, by 20 oz. extra weight. The stability of P equalled 12 oz.; that of Q, 24 oz.

Sixteenth.

Experiment 82.—The boat Q was tested against the boat R, being 11 inches wide, 28 inches long, of the bird or duck shape, each weighing 5 lb. 1 oz. Q sank in the water $1\frac{3}{8}$-inch; and R sank $1\frac{3}{8}$-inch.



The boat Q beat the boat R, by 4 oz. extra weight. The stability of Q was 25 oz.; that of R, 29 oz.

Seventeenth.

Experiment 83.—The boat Q was again tested with a boat T, of similar dimensions, being 8 inches wide, 28 inches long, but each weighing 4 lb. 6 oz. Q sank in the water $1\frac{3}{8}$-inch; and T sank $\frac{7}{8}$-inch.

The boat T beat the boat Q in speed, by 32 oz. extra weight. The stability of T equalled 16 oz.; that of Q, 24 oz.

Experiment 84.—This experiment was made to ascertain the law of the density of water with respect to bodies floating upon its surface, and the displacement they occasion. A tin vessel of a square form, and measuring 4 inches cube, was put on the water; and having first noted the displacement by its own weight, 2 oz. were then put into it, when their displacement was carefully marked upon one of the sides of the vessel. Another 2 oz. being added, the displacement was again marked; and so on to a third, &c., &c., up to 16 oz., altogether making, in the whole, eight divisions. Upon measuring the several divisions recorded, they were found all equal; consequently, showing that equal weights caused equal displacements.

(To be continued.)

On a New Mode of Measuring High Temperatures. By Mr. John Wilson, of Bridgewater.*

After referring to and describing briefly the pyrometers at present in use, the paper explained the method employed by the author to measure high temperatures. According to his plan, a given weight of platinum is exposed for a few minutes to the fire, the temperature of which is required to be measured, and then plunged into a vessel containing water of a determined weight and temperature. After the heat of the platinum has been communicated to the water, the temperature of the water is ascertained; and from this is estimated the temperature to which the platinum was subjected. Thus, if the piece of platinum employed be 1000 grains, and the water into which it is plunged be 2000 grains, and its temperature 60°, should the heated platinum when dropped into the water raise its temperature to 90°, then $90°—60°=30°$; which, multiplied by 2, (because the water is twice the weight of the platinum,) gives 60°, that an equal weight of water would have been raised. Again: should the water in another case gain 40°, then $40°\times2=80°$, the temperature measured by the pyrometer. To convert the degrees of this instrument into degrees of Fahrenheit, we must multiply by 31·25, or $31\frac{1}{4}$. Thus, $80°\times31\frac{1}{4}$, would give 2500° of Fahrenheit. And $60°\times31\frac{1}{4}=1875°$. The multiplier 31·25 is the number expressing the specific heat of water as compared with that of platinum—the latter being regarded as 1.

In order to attain very accurate results by this method, precautions similar to those required in determining the specific heat of bodies must be taken; that is, it is necessary to guard against the dissipation of heat by conduction and radiation. The apparatus used by the author consists of a polished tinned iron vessel, of a cylindrical form, 3 inches deep and 2 inches in diameter; this is placed within a concentric cylinder, separated from the enclosed vessel about $\frac{1}{4}$-inch. By this means there is but little heat lost during the experiment, either by radiation or conduction.

At the commencement of the experiments, the author imagined it would be necessary to employ a considerable proportion of water, and

* From the London Journal of Arts and Sciences, July, 1852.

therefore took 25 times the weight of the platinum; but he found that the temperature gained by the water, even in cases of very high heats, did not exceed 4° or 5°—and an error of 1°, when converted into degrees of Fahrenheit, amounted to 400°. To obtain results within much narrower limits of error, it became obvious, a much smaller proportion of water should be employed; and ultimately it was found that double the weight of the platinum was in all cases sufficient.

There is no appreciable loss of heat from the evaporation of steam when the hot platinum is plunged into the water; there is probably no actual contact with the water until the platinum is fairly at the bottom of the water. It is in fact the converse of dropping water on a plate of platinum or iron strongly heated; in which case the water, instead of being suddenly dissipated as steam, assumes the spheroidal form, and runs about over the plate without coming in contact with the heated surface. It is only when the temperature of the metal becomes much reduced that the water is rapidly converted into vapor.

In ascertaining temperatures by this pyrometer, a correction has to be made for the portion of the total heat that is absorbed by, 1st, the mercury of the thermometer in the water; 2d, the glass bulb and stem of the thermometer; 3d, the iron vessel containing the water; 4th, the heat retained by the piece of platinum.

The portion of the total heat that is absorbed by these several bodies, compared to the portion received by the water, will be in proportion to their several weights, and the specific heat of each compared with water.

				Equivalent grains of water.
Mercury,	200 grains	× $\frac{1}{30}$th	specific heat =	7
Glass,	35 "	× $\frac{1}{6}$th	"	6
Iron,	658 "	× $\frac{1}{9}$th	"	73
Platinum,	1000 "	× $\frac{1}{32}$d	"	31
Total,	. . . .	. . .	. .	117

Therefore the effect of these bodies is equivalent to the addition of 117 grains to the 2000 grains of water,—or $\frac{1}{17}$th has to be added as a correction to all the temperatures obtained by this instrument; or, in other words, the multiplier must be increased from 31¼ to 33 in this instrument, and in all similar ones where the weights of the mercury and glass of the thermometer, and of the iron vessel, are the same as stated above.

As the piece of platinum is the most expensive part of the apparatus, it is proposed to use a small piece of baked Stourbridge clay as a substitute for the platinum. The author has found, by experiment, that a piece of Stourbridge clay, 200 grains in weight, when heated to the melting point of silver, and plunged into the tinned vessel containing 2000 grains of water, raises the temperature of the water, 41°.

Now, if 1890° Fahrenheit (the melting point of silver) be divided by 41, we obtain 46° as the number corresponding to 1° of this pyrometer; and 46 will therefore be the correct multiplier; and no corrections are required for any heat abstracted by the thermometer, the tinned vessel, or the piece of clay.

The temperature of all sorts of furnaces and flues of steam engines, &c., may be readily ascertained by means of the piece of Stourbridge clay.

The chairman expressed the interest he felt in this new pyrometer that had been brought before the meeting, and considered it an ingenious and efficient instrument. He remembered having had a conversation with the late Prof. Daniell on the subject of his pyrometer, and expressing a doubt of the nearness of the approximation in the results obtained from that instrument; in fact, such delicate manipulation was required in using it, that it was scarcely available except in the hands of the inventor himself. But Mr. Wilson's instrument was so extremely simple in the construction and practical application, that an accurate measure of the quantity of heat could be relied upon, with ordinary care in the employment of the instrument. It might be theoretically considered, that quantity of heat was a different point from intensity of heat,—as in the case of voltaic electricity the difference between quantity and intensity was known to be so strongly marked in the different effects produced; and this pyrometer, although measuring correctly the relative quantity of heat required to melt different bodies, might give far from a correct measure of the relative intensity of different fires. However, the same theoretical question applied of course to the ordinary mercurial thermometer, which was also the standard of measure in this pyrometer, and to all thermometers which measured the degree of heat by the relative expansion of any body by heat, whether mercury, iron, or air.—*Proc. Mech. Eng., Birmingham.*

Remarks.—We do not doubt that for practical purposes, the very neat and simple process proposed by Mr. Wilson will be found very convenient and valuable; but for scientific accuracy, the loose establishment of equivalents will not answer, nor can the instrument be relied upon for delicate determinations, until the specific heat of platina at high temperatures shall have been determined; at present it is simply unknown. The pyrometer, invented by Prof. W. R. Johnson, used in the experiments on the explosions of steam boilers, by the committee of the Franklin Institute, and described in the *American Journal of Sciences*, vol. XXII, p. 96, and Report of the Committee, part II, p. 16, is analogous in principle, but far less convenient in practice. Ed.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, September 16, 1852.

Samuel V. Merrick, Esq., President.

John F. Frazer, Treasurer.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A communication was read from the Metropolitan Mechanics' Institute of Washington, D. C., informing the Institute of their organization, accompanied by a copy of their Constitution and By-Laws.

Donations were received from Messrs. A. S. Barnes & Co., New York; The U. S. Light House Board; Hon. Joseph R. Chandler, U. S. Congress; J. Amery, Esq., Boston; Messrs. John F. Frazer, Richard B. Osborne, W. H. C. Riggs, Charles E. Smith, J. A. Kirkpatrick, and the Pennsylvania Railroad Company, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of July.

The Board of Managers and Standing Committees reported their minutes.

New candidates for membership in the Institute (12) were proposed, and the candidates (13) proposed at the last meeting were duly elected.

On motion, it was

Resolved, That the Franklin Institute see with great pleasure the formation of a new Association for the promotion of Manufactures and the Mechanic and Useful Arts, in the City of Washington, and that they will do every thing in their power to promote its ends.

Resolved, That the Corresponding Secretary be directed to communicate this resolution to the Metropolitan Mechanics' Institute.

Dr. Rand, Chairman of the Committee on Meetings, presented to the meeting a model of an improvement in Carriage Axles, invented and patented by the Rev. Kingston Goddard, of this City. The nature of this invention consists in making the box in two or more parts, with a recess to receive and embrace a collar on the journal part of the axle, or what is essentially the same, with a projecting fillet to fit into a recess in the journal part of the axle, when this is combined with the mode of securing and holding the box on the axle, by making its periphery conical, to fit and be drawn into the hub, or into a pipe-box fitted to the hub, so that by simply securing the box within the hub or pipe-box, the axle is at the same time secured within the box. The advantages claimed for this arrangement are to be found in the ease and regularity of motion produced, the perfect safety of the apparatus, its retention of oil, with facility of cleaning and repair.

Dr. Rand also exhibited a piston of a steam cylinder, which had been received from Mr. M. W. Baldwin, and which was so much corroded as to be ruined by the action of rosin oil, which had been used upon it as a lubric. Dr. R. remarked, that in preparing this oil by the destructive distillation of rosin, a large amount of pyroligneous acid was formed, and it was undoubtedly to this that the corrosion was to be attributed. Mr. Greble had informed him, however, that he had used a rosin oil on a large shaft running through a cellar, and had found that it did not gum, nor corrode the metal, while it remained fluid at temperatures at which other oils became stiff. The difference in the oils was due to the care used in their preparation, and the pains taken to separate completely the pyroligneous acid.

Dr. Rand called the attention of the members to the interesting results of some experiments on the strength of sheet iron and copper, made by Mr. Joseph Harrison, Jr. The sheets were confined between two hemispheres, into the lower of which water was forced; the deflection was measured by means of a rod passing out through the upper one. A sheet of copper, full $\frac{1}{32}$-inch thick, at 532 pounds to the square inch, was not bursted, but had assumed an uniformly dome-shaped form, as perfectly as if stamped with a die, and was much drawn at the bolt holes; the deflection in the centre was $2\frac{1}{20}$ inches. A sheet of Russia sheet iron, $\frac{1}{32}$-inch scant, at $84\frac{1}{2}$ pounds became also dome-shaped, and burst at a flaw

nearly midway between the centre and circumference, the deflection at the centre being ¾ of an inch full.

Mr. James Young, Printer, of Philadelphia, exhibited an Anti-Friction, Self-Acting Press, for book, job, and card printing, and made the following remarks upon it:

This press is anti-friction in the same sense as Dick's anti-friction press, and self-acting in the same sense as the self-acting cotton mule. Its advantages generally over any other press consist in its greater power, better adaptation of the lines and position of the metal to bear greater strain, with a less weight of metal in the whole machine than any that has yet appeared for type printing. It is simpler in construction, having fewer pieces than a hand press with rolling or inking apparatus attached; it has a "throw-off" so constructed as to throw off the impression at the last moment before actually giving the pressure; it has also an improvement in distributing the ink, and of self-action in unfastening and fastening the form solidly in a moment, without screws or wedges. The sheets can be fed on the press at any desired angle between 45° and a horizontal line; the pressure on the nippers that hold the sheet can be regulated at will. A further description and engraving of the press will be given when patents have been secured in Europe.

Mr. Aldritch Moore exhibited A. S. Macomber's Patent Feed Cutter. In this machine the frame that holds the knife is of cast iron, and is fastened to the front posts by screws, with a projection for boxes, in which the ends of the cylinders are placed. There is also another projection, with a mortise, into which the knife is placed, and confined by means of screws at both ends; there is also a screw at each end of the back of the knife, intended not only to hold the knife from moving back, but also to move it forward as it wears. The cylinders are of cast iron, with spiral flanches of any desired number. The cylinders are so placed that the flanches of the upper will play as near the centre of interval between the flanches of the lower as possible. The flanches, when revolving, act as feeders, and draw the article to be cut in contact with the edge of the knife, where it is cut. The knife may be sharpened by placing a little emery and oil on the flanches, and turning the machine back, the knife being at the same time started forward by the set screws. This machine claims the advantages of greater simplicity and ease of operation; having but a single straight knife, it is easily kept in order. It has been applied for cutting paper and rags, as well as feed, and has been found to answer admirably.

Dr. Kennedy called the attention of the meeting to an improved Ear-piece for Acoustic tubes. These tubes, by which communication is maintained between different apartments in hotels, factories, stores, offices, &c., were coming into very general use, and were even supplanting the door and servant bells in dwellings. Formerly, it had been necessary to put up a line of bell-wire with bell attached, parallel with the tubes, to call the attention of the individual addressed; such had been the arrangement in the late Barnum's Museum in this City. Messrs. Woolcocks & Ostrander, of New York, have removed all necessity for a bell, by placing a whistle in the ear-piece, which utters a shrill sound whenever the tube is blown through from the other end, and thus warns the hearer. The whistle

blocks up the bore of the ear-piece, wherein it is kept by a spring, and from which it may be displaced by depressing a small lever on the outside, leaving the calibre free for conversation. A small hinge-valve, which covers a lateral orifice in the ear-piece, is thrown up by the force of the breath in whistling, and remaining elevated, gives further assurance that a hearing is demanded. The expense of these tubes is but little if any greater than bell hanging. The articles exhibited came from Mr. T. Butler, tin and copper smith, Seventh street, a few doors from the Institute, who would furnish tube at $3 per 100 feet, and patent ear and mouth-pieces at from $2 to $2·50 the pair.

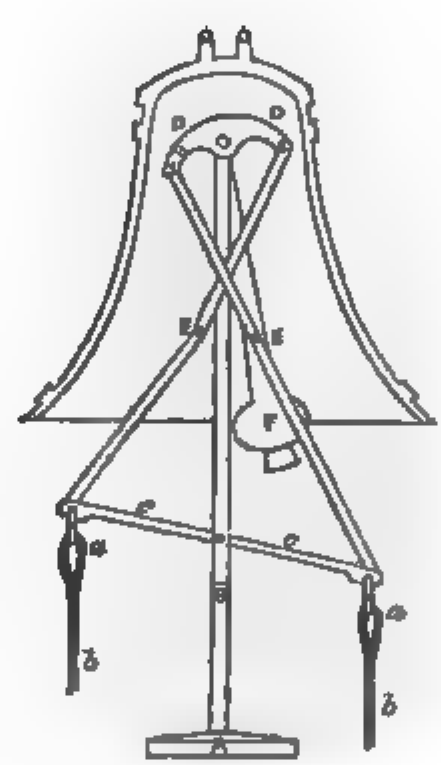
Dr. Kennedy also exhibited specimens of French Enamelled Ware, from the house of M. Engler, 128 Rue Vieille du Temple, Paris. The enamel covered the inner and outer surfaces of the iron vessels, which were not cast, but stamped. Stamped vessels of tinned and of enamelled iron were stated to be in common use in France, where they were fast taking the place of the ordinary grooved and soldered tin-ware. The absence of sharp angles and crevices, which retain dirt, gave the former a great advantage on the score of cleanliness. Dr. Kennedy further said, that the business of enamelling iron was fast assuming importance on the Continent. He had seen in the National Porcelain Manufactory at Sevres, near Paris, vessels fashioned of iron, covered with porcelain, and most elaborately ornamented. The expense of enamelled culinary articles was but slight; he had bought at the establishment above mentioned an iron saucepan of the capacity of a quart, and enamelled on both sides, for 1¼ francs (about 24 cents). The saucepan was so thin that it could be heated over a spirit-lamp like an evaporating basin, and had been used in his laboratory for several months, subjected to the action of acids and fatty matters, without perceptible injury to the enamelling. Signs perfectly indestructible by ordinary wear and tear are made of enamelled iron. These are frequently seen on the mile posts and *grade indicators* of European railroads; also at the corners of the streets of cities, bearing the names of the streets. A street sign, about 25 inches (63 centimetres) long, with a row of three-inch letters, is furnished at five francs. Breast-pins, plant labels, tomb tablets, and a host of other articles of beauty or utility, are cheaply supplied by the skill of the French enamellers.

A Dioptric Apparatus of Fresnel, of the first order, furnished with a cupola and lower zones of catadioptric rings, made by Le Paute, of Paris, for the light-house on Carysford reef, Florida, had been put together under the direction of Lieut. George Meade, of the corps of the United States Topographical Engineers, and the members of the Institute were kindly permitted by him to view it. The eight panels of the central belt consist of four annular lenses and four cylindrical elements, which revolve around the light in the focus as a centre, presenting the vertical bar of light which characterizes the fixed light visible in every azimuth, the annular lenses interrupting in their revolution the *central portion* of this beam of light, and concentrating it in one great flash of intense brilliancy. By the revolution of the central belt, a single annular lense in it produces a similar, and even a better effect, than the vertical cylindrical element revolving around the drum of the fixed light apparatus heretofore in use. It is, moreover, more simple, less weighty, and intercepts less light,

:h as one lense is substituted for two. It was explained to the ; by G. W. Smith, Esq. The four wick lamps, he stated, were ve, complicated, and occasionally, though very rarely, liable to :ment, and required some skill to repair them. In England, the ical lamps have been superseded by a common fountain or vessel aced above, provided with a tube, conveying the oil to the burner; mediate regulating reservoir, provided with a floating ball, gives isite supply. In France, moderator lamps, so called, have lately : instances been substituted; they consist of a heavy loaded piston, s perforated, and by its pressure in descending, forces up the oil a tube to the level of the burner, and receives the overflow on its urface. This lamp, however, is defective in principle, from the height of the column of oil, and on that account was rejected by who invented the same some eight years since. A piston moving tally in a box, the pressure being applied over a pulley by a weight ling vertically, will of course sustain a column of uniform height, refore of uniform resistance; this plan of Mr. S's., he deemed prefera- the moderator, but still he thought the fountain to be superior to either t-house lamps, although his arrangement of the horizontal piston is itable for domestic lamps.

S. proceeded to state that a careful examination of the screw pile ouse, on the Brandywine Shoal in the Delaware Bay, had shown had successfully resisted the ice of the last three years without sus- injury, and last winter it was repeatedly assailed by vast masses; happy also to inform the meeting, that the iron pile light-house on rd Reef, had resisted all the storms since its erection, and especially tremendous hurricane.

Thomas A. Stran, of New Albany, Indiana, exhibited to the meet- model of his Apparatus for Ringing which will be understood by a refer- the accompanying figure.



pedestal, A, and upright shaft, B, and C, and lever, D D, and compound E E, and bell clapper, F, may all be f cast or wrought iron, or other metal. edestal, A, may be made any suitable and breadth, and fastened to a suitable by means of screws and bolts, to sus- upright shaft and combined fixtures ing the bell. The shaft, B, is made of igth that may be desired to suit the or situation of the bell.

levers, C C and D D, and the com- lever, E E, must necessarily be go- in their length by the size and dimen- f the bell. The links, *a a*, are for the of attaching the bell ropes, *b b*.

Stran claims for this arrangement the ges of simplicity and cheapness. The ng stationary, the jarring to the building is prevented; the utmost

precision in ringing can be attained with but a slight exertion of force. The bounding of the clapper is prevented, and thus one great cause of the breakage of bells avoided.

Frederick Graff, Esq., the Superintendent of the Schuylkill water works, being present, Mr. Smith stated that for eight years past, he had been engaged in examining the amount of sediment held in suspension in that water as delivered in the city; he had made in that time, nearly four thousand experiments with a porcelain cylinder, into which the water was daily poured, allowing it to remain undisturbed for a given period, and then examining the amount of sediment. The general result, which is all that he would present to the meeting, was, that the amount of deposit was much greater than was usually supposed, and that even under the most favorable circumstances, when the water was in its best condition, the deposit was always perceptible within the first six hours from the commencement of the settling, and in many cases continued to settle even for forty-eight hours. The reservoirs on Fairmount are of but limited dimensions, and cannot be used advantageously for subsidence. It will scarcely be credited in the cleanly City of Philadelphia, that these reservoirs, some of which are nearly forty years old, have never been cleansed until the present year. Mr. S. briefly described the disgusting nature of the deposit that had been removed, and the sources whence it had been derived; that in fact, the only reservoirs of subsidence were the stomachs of the citizens of Philadelphia; he was astonished that they had not long since revolted at this impurity. He described an ingeniously contrived reservoir of subsidence, devised by J. Price Wetherell, Esq., similar in principle, though larger in scale, to that used by him in his white lead factory, and regretted that his liberal offer for constructing the same had not been accepted by the Councils of the City. The Cities of New York and Boston possess great advantages over us, in the fact that their supply is not drawn from a turbid river, but from large, deep, and pellucid lakes. Mr. Graff stated that the chemical analysis showed that the water of the Schuylkill was as pure as that of the Croton, or of the Cochituate, which Mr. S. admitted, provided it was previously filtered, but not otherwise.

Mr. S. also gave an account of an apparatus for economizing the heat which is now totally lost by the use of foul air flues for ventilating rooms; the common respirator some dozen years since, gave him the first idea of recovering the heat from the warm air now uselessly expelled into the atmosphere. A box packed with metallic wire gauze in numerous parallel layers, was to be placed in the foul air flue, in which it would soon acquire the same temperature; a similar box was to be placed in the adjoining foul air flue; when the first box had acquired the necessary elevation of temperature, the effluent valve was to be closed temporarily, and the cold air from without made to pass by a similar valve through this heated box on its way to the main heating apparatus, to be still further heated. The inconvenience of this apparatus would be twofold; first, the necessity of employing machinery or attendants to work the valves by which the currents are made to alternate from one box to the other, as they are alternately hot and cold; second, the inconvenient, unpleasant, and unhealthy deposit of moisture on the cold metallic surfaces in the box, from

the effluent foul air, which moisture would be again introduced into the room on the change of the current of air; he therefore modified this plan, by the introduction of a number of pipes into the fresh air flue from without, which pipes would convey the foul air to the external atmosphere, without permitting any mixture of air to take place in the flue, and which would be sufficient in extent of surface and in number to absorb all the *available* heat of the effluent foul air; where mechanical forcing machinery is not employed, sufficient heat must be left in the air to insure its ascent, and thus to ventilate the apartment. The condensed water would be from time to time drawn off from the lower part of the tubes without mingling with the fresh air on its passage to the main heater.

Mr. Jacob D. Sheble exhibited several forms of the stereoscope, very simple, cheap, and portable, with a diaphragm, which he stated enabled persons who could not readily adjust their eyes with the ordinary stereoscope, to use them with facility. The common reflecting pseudoscope was also exhibited by him, very cheap in its construction.

BIBLIOGRAPHICAL NOTICES.

The Model Architect,—containing original Designs for Cottages, Villas, Suburban Residences, &c., accompanied by Explanations, Specifications, Estimates, and elaborate details. Prepared expressly for the use of Projectors and Artizans throughout the United States. By Samuel Sloan, Architect. Philadelphia: E. S. Jones & Co. 1852.

We have delayed reviewing this interesting publication until the completion of the first volume, now before us, as there is generally much inequality in the contents of such works, and it is necessary to examine many numbers before it is possible to form a correct opinion of their average value, and a careful examination of this work has strongly confirmed this opinion; the designs are of very unequal merit; with many of them we have been exceedingly pleased; the general arrangement of the cottages, villas, &c., is exceedingly picturesque, ornate, without meritricious adornment, and the plans combine the best modern improvements and conveniences, without the necessity of extravagant expenditure. While there is, however, much to gratify the eye, and satisfy the judgment of the architectural critic, we reluctantly perceive a few of the designs which do not manifest purity, either in their masses or details; it is true, that a certain latitude or license is allowable in private residences, where even the caprices of the proprietors are at least tolerated by the public taste; a more rigid adherence to rule is expected in urban buildings, but especially if they be public edifices. It is very difficult to draw the fine line of demarcation between commendable originality and servile adherence to precedent, an adherence which is the bane of genius, and which in its very essence, is hostile to all improvement, an incubus which forbids the genius of architecture to soar into the regions of the untried, or to display the beauties resulting from novelty and invention; yet this adherence is what

specially has characterized the architecture of the last three centuries. The architect has been compelled to walk in the same wearisome, monotonous round trodden by his predecessors, and to be trodden by his successors, if the purists are to remain in the ascendant. The decree has gone forth from them, that the fashion is to be as immutable as in the days of the Medes, and that a building is to be pronounced without the pale of fashion, and therefore of endurance, unless it be a fac simile of those that have preceded it. We read much in the æsthetic school of rigid transcendentalists, of the great and by them styled eternal principles which should govern architectural composition; it is true that a few such great principles unquestionably exist, and can be easily demonstrated, but their number is much less than the purists would wish us to believe. After all, mere fashion has nearly as much to do with architecture as with dress, furniture, and articles of virtu; and the great latitude which has been allowed in these latter, in all ages and countries, has only been less tolerated in the forms displayed by architecture from the more permanent character of the materials, and the consequent impossibility of frequent capricious changes. Nearly a thousand years ago, the Romanesque, Byzantine, and Lombardic, gratified our ancestors, wholly regardless of the classic schools of Greece and Rome; a few centuries later, the mediæval pointed began to aspire towards heaven, disdaining the low and long horizontal lines of Greece; change followed change so rapidly that scarce two buildings could be found with identically the same features, and the last expiring school of the pointed style bore but a feint resemblance to its early predecessors. The Cinque Cento and Renaissance soon superseded the pointed mediæval, which remained in a state of suspended animation until the present generation have disinterred and endeavored to resuscitate it, with what success, the majestic fane of Trinity Church, New York, towering to the skies with a grandeur and a purity as yet unsurpassed by any edifice erected in that style since the first settlement in the United States, may attest.

The ancient Roman school next attracted the universal approval of Christendom, until Stuart and Revett presented the still more ancient claims of Greece, when an eruption of pseudo Greek buildings, which would have astonished an inhabitant of Attica, began to deform, and in a few cases to beautify the civilized world. The Greek mania has now greatly subsided: the straight jacket has been removed, and edifices built mainly according to Greek principles, without a too servile adherence to their forms or details, and invested with all the improvements of a modern civilization which the Greeks never knew.

A new era at length arrived; the moderns, repressing their inventive faculties, were content, after the manner of the much ridiculed Chinese, merely to copy; and after an age or two, wearied with the monotony of one school, resorted to the scarcely less irksome task of copying another; until at length a glimpse of returning reason led them to perceive that much, if not equal beauty might be found in the schools of widely separated eras. The present taste is more cosmopolitan than in any previous age of the world. We may find in one and the same city specimens, or intended to be such, of each and all the eras which we have previously named; but all copies, with scarcely an attempt at originality; nay, we

have even seen a design by a soi-disant architect, combining them all in one and the same building—a vision doubtless revealed to him in a nightmare, and eminently calculated to produce one in the spectator. Indeed, were a building to arise, graceful in its form, harmonious in its proportions, and exquisite in all its details and accessaries, and strictly conforming to the few generally received cannons of beauty, but without an adherence to the mere conventionalities of the schools, we very much doubt, nay, we do not doubt at all, whether it would not be denounced as a monster, and its designer charged with intolerable presumption, and inordinate self conceit. In applying these remarks to the book before us, our readers may perhaps praise the very non-adherence to precedents, which Mr. Sloan has exhibited by his non-adherence to purity in some of his designs, although we must confess, that the stays of our grand-mothers, and the cocked hats of our grand-fathers, as parts of the dress of one individual, seem somewhat unfashionable, even if they be not irreconcilably incongruous; we hail, however, the appearance of this, as of all similar works, for the diffusion of the knowledge of architecture among our almost untaught people. The plates are well executed, the explanatory letter-press written in a plain, agreeable style, and we trust the work will long be continued, and meet with increasing patronage.

G. W. S.

Blatchford's Circuit Court Reports, Vol. I. By SAMUEL BLATCHFORD. Auburn, Derby & Miller, 1852: Philadelphia, T. & J. W. Johnson.

The above is the title of the first volume of Reports of Cases determined by Mr. Justice Nelson, with the Associate Judges Betts, Conkling, Prentiss, and Judson, in the several United States Courts for the Second Judicial Circuit, (New York, Connecticut, and Vermont.) The work is here noticed because it is deemed of great value to patentees, patent solicitors, experts, and scientific mechanics. It contains decisions of Mr. Justice Nelson upon one hundred and eleven points of patent law and practice, a more numerous and important collection of adjudications upon this branch of Law than can be found in any previous volume of Reports. The great reputation which Judge Nelson has acquired in patent cases renders the opinions contained in this volume of the highest authority. The cases here reported involve questions arising under the latest amendments of the patent laws—questions as to what constitutes patentable invention—what acts amount to an abandonment of an invention—invalidity of re-issued patents—jurisdiction of Circuit Courts over infringements committed out of their districts—evidence—account—injunction and damages, &c. An interesting opinion is also reported in a case arising under the act granting patents for designs, (the first reported case we believe under that act;) and another on the much debated question of the right of defendants to an issue or jury trial, in suits for infringement brought upon the Chancery side of the Court. The Woodworth patent, the Blanchard gun-stock patent, Allen's gun-lock patent, and Wolf's car wheel patent, are explained, commented upon, and their limits defined. The able arguments of counsel in the great case of Wilson vs. Rousseau,

which are omitted in Howard's report of this case, (4 Howard, 646,) are here given at length, and much interest is thereby added to the case.

It will be remembered that Mr. Justice Nelson presides over the Circuit Court in New York, where a very large proportion of all the patent cases of the country are tried. Patentees, and all persons owning or engaged in the protection of patent rights, as well as those seeking to restrain illegal encroachments on public rights, are under deep obligations to Mr. Blatchford, for thus circulating the wise, sound, and protective doctrines of Mr. Justice Nelson on this subject. The copiousness of the reports, the lucid arrangement of cases, and the complete digest contained in the index, add much to the value of the work.

We understand that the reporter has in his possession materials sufficient to enable him to publish a second volume in the course of another year. We sincerely trust that the encouragement extended to this volume will be such as to induce him to send the second to press at an early date. Messrs. T. & J. W. Johnson are the publishers in this city.

G. H.

Elements of Natural Philosophy. By W. H. C. Bartlett, D. D. II. *Acoustics.* III. *Optics:* New York: A. S. Barnes & Co., 1852.

We had occasion in a former number of our Journal, to notice the appearance of the first part (Mechanics) of this work of Prof. Bartlett, and the appearance of this second volume, containing the treatise on Acoustics and Optics, has not disappointed us.

Any student who has endeavored to acquire a good knowledge of either of these subjects from the books usually accessible, will appreciate the value of a treatise, which is clear and precise in its explanations, careful in its definitions, and simple in its method, which, while it does not discard mathematical formulæ, restrains them within limits, and does not allow itself to be transformed into a mere book of exercises in transcendental algebra. The connexion between the two branches, the effects of similar causes, is very clearly maintained, and their differences and the causes of these differences lucidly shewn. The theory (especially that of sound) is very beautifully made out, and its applications to practice abundantly and well illustrated; though we think the explanation of the discordance between Newton's formula for the velocity of sound, and the results of actual experiment, might have been improved by consulting the recent papers of Cauchy, Prof. Challis, and others. The theory of music is very simple and happy, and well derived from the antecedents; and we think that if any one were to carry out the views here taken, we should hear little more of the indignant rejection by musicians of any connexion between their art and the physical sciences. The article on temperament is one of the few to be found, which are to be understood by any but a technical musician.

The treatise on Optics will also be very valuable as a text book, of which we are in very great want; the treatise of Sir David Brewster being too merely popular, while the most of the other works are rather mathematical exercises than explanations of physical phenomena.

[illegible]

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

NOVEMBER, 1852.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Remarks on the Application of Steam to Ships of War. By WILLIAM N. JEFFERS, U. S. Navy.

The evident superiority which a steamer possesses over sailing vessels, in the navigation of the rivers and along the coasts, and, within late years, the success of extended voyages by steamships, has very naturally suggested the more extended application of steam to ships of war. The advantages of rapidity and certainty of transit, her independence of fickle winds and adverse tides, are so striking, that even the least conversant in naval affairs esteems himself competent to decide the question, and joins in the cry which denounces as "old fogyism," the expression of a doubt as to the ultimate advantages to be derived from the substitution of steam for its more economical rival.

To the present time, this asserted superiority has not been proved to exist, and it is very doubtful whether the efficiency of the navy, far less that of an individual ship, has been increased by the means already adopted.

I have been led to make these remarks, by reading in an article in the July number of this *Journal*, from the pen of a distinguished authority, (W. Fairbairn,) the following:

"Steamers can back out of difficulties and dangers, when sailing vessels must remain exposed; they can assail the enemy at a great distance, and take up any position they choose; and with their great guns and long range, inflict severe punishment, and do great execution, without receiving a single shot."

We have here in five lines five assumptions, at least four of which we think erroneous, and shall proceed to state the grounds for our opinion.

We do not pretend to deny any advantages which may be claimed for the steamer in a littoral warfare; but for that purpose celerity of motion, light draft of water, and capacity for the accommodation of large bodies of troops, are indispensable. Such enterprises are not successful by reason of any force in the steamers, but in their unexpected presence in front of the enemy, or success in clearing natural or artificial obstacles, supposed sufficient to bar their progress.

That this view of the case is a correct one, is shown by our own operations in the Gulf during the war with Mexico, and the warfare of the English in China. The vessels employed on these occasions were in no respect capable of sustaining an action with sailing ships of war, and owed their success to the weakness and unprepared state of the enemy; they were common steamboats, purchased for the occasion, and for similar occasions always to be procured at a day's notice.

But the principal duties of a navy are upon the open sea; engaged in convoying our own merchant ships; the capture of the fleets of the enemy; the destruction of his commerce; cutting off his supplies; capture of colonial dependencies; the transportation of large bodies of troops from point to point, and the blockade of his harbors. These are the duties of the navy. But if called upon to man floating batteries, and to defend harbors which may be better protected at less cost by permanent fortifications, or to land in large bodies, and effect permanent lodgments on the enemy's territory, good seamen are at an enormous cost turned into indifferent soldiers. To perform these specific duties, suitable ships in sufficient numbers must be provided. What are suitable ships?

A man of war, to be efficient, must be able to keep the sea for a considerable period, certainly four months; otherwise, her frequent entrance into port for supplies, would give the enemy all the information he desired as to the force, destination, and cruising ground of the fleet or ship. None but the smallest sailing vessels are forced into port oftener than once in four months, while the larger ships may keep the sea six months. Steamers of full power, that is, those capable of making ten knots and upwards under steam alone, are unable to carry more than fifteen days' fuel, which may be made to last with very moderate speed double that period, or thirty days, and without fuel they are comparatively helpless; consequently, when the scene of the intended operations is distant, the sailing ship can reach the rendezvous in as short a time as the steamer. The greatest distance yet passed over under steam was about 4000 miles, at an average rate a little less than eight miles an hour; while the passage of the *Flying Cloud* to San Francisco exceeded the rate of eight miles and a half an hour, and was but three or four days longer than those of the *Golden Gate* and *Winfield Scott*, two crack steamers, which were forced to make three ports by the way. The propeller steamship *S. S. Lewis* reached San Francisco in 124 days, beaten by nine-tenths of the California fleet.

It may be objected to this comparison, that our men of war do not equal the *Flying Cloud* in speed; nor are the steamships in this respect equal to the Golden Gate. The speed of our men of war is not, however,

to be judged of by their passages, for we have no object in forcing our ships, and under ordinary circumstances in time of peace, no officer is justified in risking the smallest spar; the object of the cruise is accomplished by the presence of the ship on the station. Nevertheless, the passages of some of our ships have never been equalled by the finest of the clipper fleet.

We are of opinion, therefore, that it is not proven that the steamer possesses any great advantages in making a passage, except under peculiar circumstances of constantly adverse winds and currents, when the distance is greater than the steamer is enabled to make without calling at a port or ports by the way.

Hitherto we have considered the relative capabilities of the two ships for keeping the sea or making a passage, but it must be evident that this is one of the least of the conditions to be fulfilled.

The extent of a navy being governed by the ability of the nation to sustain the cost of construction and maintenance, the steamship ought to be of at least equal military force with her sailing rival of the same cost; else, on her arrival at her destination, she will be forced to accommodate herself entirely to the movements of the enemy. On this point, the relative force of the two ships, the most erroneous notions prevail. One gun mounted upon a steamer is assumed to be equal to the battery of a ship of the line. This notion is, however, but the reproduction of a long since exploded system; that of a navy of gun-boats, for steamships are but gun-boats moved by steam instead of sweeps. "In calms, gun-boats are the sovereigns of ships of the line," says an able writer; and from naval histories he gives terrible examples to prove the truth of his assertion. The system no longer has an advocate, and experience has proved that individual examples to the contrary do not invalidate the general rule that superior force must ultimately triumph.

The great fallacy upon which the enthusiast and the ignorant base their argument in support of this opinion is, that steamers are able to assume at will any position, in spite of the efforts of the sailing ship. They begin with the assumption, that a dead calm prevails, and their adversary floats motionless on a glassy sea, "like a painted ship upon a painted ocean," helpless. This assumption cannot be granted, for an examination of the logs of many ships shows that calms are by no means common; in fact, that, except in the close proximity to land, and in certain latitudes easily avoided when lying in wait for an enemy, it is very uncommon for a ship not to have steerage way. We will, however, admit, that it is during a calm that a well appointed steamer falls in with an equally well prepared frigate. The effective range of the eight and ten inch shell guns, with which steamers are armed, is about 1200 yards, and of course, with her very small number of guns and ability to choose distance, it is her advantage to maintain the distance which makes her gunnery most effective. At this, as well as at any other distance, the eight inch shell guns of the frigate are at least as effective as those of the steamer, while the whole battery of 32's will tell with solid shot; consequently, the steamer must avoid the frigate's broadside; but to pass over a quarter of a circle to get from the broadside to the stern or bow of the sailing ship, she must pass over a distance of 2000 yards, which at eight miles the hour, takes eight minutes. Now, will any seaman believe that

the direction of the ship's head cannot be altered eight points in as many minutes? The two quarter boats, with a line from the end of the jib-boom, will tow her round; or parachute drags may be laid out abeam, (with a similar machine the late Com. Porter propelled the *Essex* three miles an hour;) or an athwartship propeller, as proposed by R. L. Stevens, Esq., and a similar one experimented on in England, worked by hand or a small engine of ten horse power. Other methods will doubtless suggest themselves; so that, in our opinion, this idea of choosing position is altogether delusive. If the steamer closes to a less distance, she comes within range of a broadside of 6½ inch shells, which, though not quite equal to the 8 inch, are yet quite sufficient for the purpose, and the steamer fights at the terrible odds of six guns to fifty.

Should the frigate be fallen in with in a good working breeze, the steamer can only choose distance, (and that only in case of being faster,) but has still less opportunity of selecting position.

Even if we grant the steamer the claimed choice of position, the advantages to be derived from this are not by any means evident; the sterns of ships are no longer made for ornament alone; a frigate can in half a minute shift six guns from her broadside to her stern, which is, in proportion to its developement, as formidable a battery as her broadside; added to which, the steamer being herself in motion at a rapid rate across the line of fire, delivers her shot at a greater disadvantage than the sailing ship, which is either quiet or slowly rotating on her heel. Steamers when not under sail are particularly uneasy in a sea-way, making the pointing their guns very difficult.

But, say the advocates of the steamer, she being armed with larger and heavier guns, will lay off abeam out of danger, and hammer her adversary without caring to choose position. This is another assumption not borne out by the facts. The steam frigates *Saranac* and *San Jacinto** each mount six eight-inch guns; four in broadside, the other two on pivot carriages; the whole may be fought on one side.† The first class frigates mount each fifty guns; eight of which are eight-inch, the remaining forty-two are of 32 lbs. calibre; by shifting over, thirty-two guns may be fought on one side. The two pivot guns are of slightly greater power than any gun on board the frigates *as now armed*, but not to such an extent as to overcome the disparity of six to thirty-two. This disparity in numbers must always exist, for the steamers are already loaded down with their machinery and battery, and any increase of guns requires a corresponding addition of men, ammunition, and provisions. The disparity in the power of the guns may be met by putting corresponding guns on the frigates; this has been done in the case of the small frigate *Raleigh*, which mounts two heavy eight inch guns on pivots, twenty common eight inch shell guns, and two long thirty-two pounders. We must confess that on comparing this ship with the *Saranac* or *San Jacinto*, we cannot believe that any advantages of position likely to be obtained by the steamer can compensate for her decided inferiority of four to one in military force.

The *Mississippi*, carrying no long guns, is, in our opinion, decidedly inferior to the preceding steamships; while the *Susquehanna* and *Powhattan*

* We prefer choosing illustrations, when practicable, from our own service.

† This is, however, at sea, a questionable advantantage; the heel towards the enemy caused by shifting over permits the deck to be commanded.

are but larger editions of the *Saranac*, and in force, as in cost, are only to be compared with ships of the line. As to the *Princeton*, her armament of four light eight inch guns, and six light thirty-two pounders, is decidedly inferior to that of any first class sloop in the navy. The first class sloops mount twenty-two guns of greater power, and would bore her through and through before she could effectively return a shot.

The favorite policy of keeping at a distance led to a preference of a few guns, and those of great calibre, more particularly adapted to the firing of shells. There are, however, certain practical difficulties in the handling of heavy guns and their shot, which very much diminish their theoretical superiority over the thirty-two, which is the calibre generally used in the frigates. In mere *range*, the eight and ten inch guns are not equal to the thirty-two, as may be shown by reference to the Ordnance Manual; and being armed with shell guns, to the exclusion of solid shot, except at short ranges, the steamship is within the reach of shot long before her guns would tell. Shells are very far inferior in both range and accuracy to shot, and in view of this, the preference of shell guns does not appear to rest on a sound basis, but is a mere theory; they are as yet untried in actual warfare, and the records of authentic practice show that not more than one-fifth the shells fired at a target placed at a known distance, explode satisfactorily. The frigate, therefore, has at great distances numerous solid shot guns for deliberate fire, and at closer quarters, a broadside of either, or a mixed volley of shot and shell, with a numerical superiority of six to one.

The heavy guns placed on the bows and sterns of steamships, are necessarily mounted on pivot carriages on the spar deck, which makes it necessary to remove the bulwarks, either entirely, as in the *Saranac*, or partially as in other steamers. This exposes the *personnel* at all distances to effects of shell, and particularly the spherical case or shrapnel shell, and at close quarters to grape. The eight inch spherical case, containing about 400 missiles, may be employed at a range of 2500 yards, a distance beyond the effective range of any other species of projectile. The principal battery of the frigate is entirely protected, and the spar deck except from a raking position, in which last case, the exposed guns being inoperative may be temporarily abandoned, and the men sheltered.

We have now to consider the steamer when forming a part of a fleet. Here, forming a part of the line of battle, the integrity of the formation must be preserved; she has no opportunity of selecting her position; her usefulness is dependent on her absolute force, and she may be crushed at once by the superior ship to which she is opposed. If she keeps aloof, or acts the part of a tow boat, her armament is inoperative, and she renders no service to compensate for her cost. But she cannot be depended upon for towing; she may be disabled, or the tow rope may be cut by shot; this last is not a hypothetical case, for the loss of a Danish ship of the line during the late troubles with the Dutchies, was owing to this cause. The tow cannot be under sail; consequently, once adrift while making sail, she is, for a short time at least, an unresisting target. The true position of the steamship is as a reserve for assisting disabled vessels, not a principal actor in the fight.

There is one point in the paragraph we have quoted which we have

not as yet attempted to dispose of. That "steamers can back out of difficulties and dangers, when sailing vessels must remain exposed," we must in the abstract admit; but in order to give them this faculty there is no necessity of depriving them of four-fifths of the military force due to their tonnage. In the side wheel steamship in our service, the engines and fuel occupy nearly, if not quite, half the whole space beneath the water line. In the *Princeton*, if all her fuel was below, not less than three-fifths of her entire capacity would be occupied by machinery, fuel, and stores; so that no economy of space, at least in this instance, is gained by the propeller. The English steam frigate *Arrogant*, which has become quite familiarly known to the readers of this *Journal*, and celebrated for her efficiency, carries but forty guns, when the battery due to her tonnage is sixty; to compensate for this diminished force, she carries but eight days' coal, steaming at sea at a maximum rate of 5·08 knots, (*Vide Jour. Frank. Inst., May,* 1852.) This is probably the maximum rate at which it is necessary that a war steamer should be propelled; it is ample for all the purposes of manœuvring, and for making head against the most rapid currents of the ocean. The boilers and machinery necessary occupying but a limited space, may be placed with, say ten days' coal, far below the water line, and when necessary, fifteen to twenty days' coal may be carried in bags. The risk of accident, which forms so serious an item to their disadvantage, to be allowed for in comparing the efficiency of the present steamers, is reduced to a mere trifle. Further improvements may be expected in the engines and boilers, and models of the ships, (the *Arrogant* is by no means a good model,) and we may succeed in giving a steamship this velocity without displacing so great a portion of her battery as to seriously affect her force.

To the present time, then, we assert that military efficiency has been sacrificed to speed, without attaining the latter, and nothing but a mongrel has been produced, as must always be the case when we aim to combine in one, several contradictory qualities. We require for one purpose, great military force, with sufficient power to render it available when calms, contrary winds, or adverse currents prevent our approaching in sailing vessels the object to be attacked; and for the other, great speed, room for the accommodation of troops, and moderate draft of water.

The first is to be obtained by applying to every ship a small propelling apparatus, the drag of which will not materially affect her sailing qualities when not steaming, but which will be sufficient to manœuvre her in presence of the enemy, enable her to enter ports, or pass through regions of calms to those of favorable winds.

For despatch vessels and troop ships, the mail steamships now in existence under contract with the government, are admirably adapted; they can carry a sufficient battery for the purposes of defence, and their speed insures them impunity where superior force is concerned. It is unnecessary to discuss in this paper, whether it is a wiser policy to continue the subsidies to these steamers and establish new lines of similar vessels, or to build vessels of similar qualities, or to trust to the natural developement of commerce. We have combated what we believe to be false positions and fallacious arguments, and have indicated the wants and requirements

of the Naval Service. The facts are indisputable, the inferences we think legitimate.

Naval officers are, of all others, most interested in this subject, for they feel that much will be expected of them in a future war, and they *know* that the means placed at their disposal are not capable of producing the required effects.

---

*Drainage of Haarlem Meer.**

It appears from a paper by Mr. Grainger, C. E., before the Scottish Society of Arts, that this great work is nearly approaching its completion. The pumping was commenced in May, 1848, from which date to April 30, 1851, the lake had been lowered 7 feet 3 inches, which was the state of matters when the subject was last brought before the Society. During the months of May, June, July, August, September, and October, very satisfactory progress was made, notwithstanding that a considerable quantity of rain fell in August and September, the level reached at the end of October being 9 feet 7·74 inches below the original surface, or at an average rate of 4·79 inches per month. In November a great quantity of rain and snow fell, raising the level about 4 inches; and in December the weather was still unfavorable, so that at the end of the month the level stood at 9 ft. 5·58 in. below the original surface, or a total gain since April 30, of 2 feet 5·58 inches, or 3·32 inches per month. This progress may appear to be inconsiderable; but, when it is recollected that the lowering of the lake one inch involves the raising of upwards of four millions of tons of water, and allowing for the rain and snow falling during these eight months, there could not have been less than 186,000,000 tons of water pumped up during that period, the performance will appear great indeed. To give a better idea of this, it was stated that 186,000,000 tons was equal to a mass of solid rock one mile square and 100 feet high, allowing 15 cubic feet to a ton. The average progress has been less last year than it is in the preceding one; but this is readily accounted for by the *increased lift* of the pumps, and by the difficulty of forming the channels which lead the water to them. At the commencement of these operations, the average depth of the lake was 13 feet 1·44 inches, and as 9 feet 5·58 inches have been pumped out, there only remained at the end of December last an average depth of 3 feet 7·786 inches. It is, therefore, trusted that the drainage will be completed, if not in the autumn of this year, at least in the summer of 1853.

Ordnance Range and Velocity.†

The longest range and greatest velocity ever accomplished by any ordnance, ancient or modern, up to the period of 1840, and we believe to the present time, is 5720 yards, or just three miles and a quarter. The whole time of flight was only thirty seconds and a quarter, which is estimated at 2100 feet in the first second of time. The piece of ordnance

* From the London Mechanics' Magazine, July, 1852.

† From the London Practical Mechanic's Journal, July, 1852.

used on this occasion was a fifty-six pounder cannon, cast on the principles of Mr. Monk, who suggested the propriety of removing a considerable proportion of useless metal from the gun before the trunnions, and adding it to the breech, where alone increased strength is desirable. This arrangement permits the use of a larger projecting charge of gunpowder, without risking the calamity of bursting. The quantity of powder employed in the experiment alluded to was ten pounds, and *the ball weighed sixty-two pounds and a half*, a circumstance which requires some explanation, seeing that we have stated the gun to be a fifty-six pounder. The explanation is this: the momentum of a projectile is the product of its mass and its velocity; by increasing that mass, therefore, or, in other words, by adding to its weight without adding to its size, we acquire a proportionate increase of momentum, and a consequent increase of range. The shot on the present occasion was an iron shell filled with lead; hence its weight of sixty-two pounds and a half. Nearly the same range was accomplished by the French during the Peninsular war, who threw shells into Cadiz, rather more than a distance of three miles; they, however, used enormous mortars, one of which is at present in St. James's Park, and employed the largest charges of gunpowder ever known in modern times; the missiles projected, moreover, were shells *nearly* filled with lead, the remaining space containing gunpowder, ignitable by a fuse, as in the common shell. The fact that leaden balls accomplish a longer range than iron ones, seems to have been discovered at least *once* by chance, the discoverers being totally ignorant of the principles on which the circumstance was founded. It is related that, during the war, an American ship having expended all her cannon-balls, and being unable to procure others of a similar kind, had some prepared of lead; when, on employing them in a subsequent action, her captain and crew were surprised at their long range and efficacy. Sir Howard Douglas is so satisfied of their advantages on peculiar occasions, that he recommends their introduction in the navy.

---

*Death of Sir James Macadam.**

Sir James Macadam, the originator of the modern system of "macadamizing" roads, died on Wednesday in week before last, at his residence in Finchleysroad, London.

Enclosure of Land from the Sea in the Netherlands.†

The first sod of the lands conceded to the Netherlands Land Enclosure Company by the Government of Holland was turned by Captain Pelly, on Thursday in week before last, at Hanswerk, Zealand, Holland, in the presence of a large concourse of the population. In the Scheldt, between Bergen-op-Zoom and Antwerp, there exist large tracts of land covered at high water by the sea, and at low water presenting a varying surface of several feet in depth of the richest alluvial soil, ever on the increase. To redeem and dispose of this land is the object of the company named, which is composed of practical men on both sides of the Channel, with Sir

* From the London Builder, No. 494, July 24, 1852.

† From the London Builder, No. 492.

John Rennie as engineer-in-chief. The necessary powers have been granted for ninety-nine years from last August, under which the company may recover and enclose land to the extent of 35,000 acres. The reclamation will cost 20*l.* per acre they say, and the land reclaimed will be worth from 60*l.* to 70*l.* per acre.

AMERICAN PATENTS.

List of American Patents which issued from Sept. 14*th to Oct.* 5*th*, 1852, (*inclusive*,) *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

17. For an *Improvement in Clothes Pins;* Samuel Aldritch, Springfield, Vermont, September 14.

Claim.—"I do not claim the invention of pins for securing clothes to the line; neither the invention of the coiled spring or lever; neither the combination of the parts of the same. But I do claim the improvement of manufacturing clothes pins from wire of any suitable metal, with the aforesaid jaws attached, operated by a spring or lever, as being the most simple, cheap, effective, and durable, of any kind in use."

18. For an *Improvement in Connecting Joints for Washing Machines or other purposes;* S. L. Egbert and S. W. Green, Willoughby, Ohio, September 14.

Claim.—"What we claim as our invention is, the construction of the joint, (by which the connecting rod is attached to the spring board,) by means of the knife edges disposed in a right line, and confined by the straps and backing piece, substantially as herein set forth."

19. For *Improvements in Printing Presses;* Charles W. Hawks, Boston, Massachusetts, September 14.

Claim.—"Having fully described the construction and operation of my improvements, I will now point out the parts which I claim as my invention.

"1st, I claim a pair of nippers, so constructed as to draw the paper from the form, by griping the margin of the paper firmly between the jaws of the said nippers, and at the same time holding the paper a little distance from the platen, as herein described and set forth.

"2d, I claim the adjustable spring and rod, for holding the nippers up from the platen, as herein described.

"3d, I claim the fingers for holding the edge of the sheet, in combination with the swing platen, as herein set forth."

20. For an *Improvement in Lightning Rods;* Herman H. Homan, Cincinnati, Ohio, September 14.

"The object of my invention is the production of a self-renewing lightning rod point, of the greatest possible efficiency of operation and simplicity of construction."

Claim.—"Having thus fully described the nature of my improvements in lightning rod points, what I claim therein as new is, 1st, The formation of the point of a lightning rod of successive sections of different metals, each being of greater fusibility than the one below it, and having oblique junctions, so that an overcharge of the electric fluid simply melts off the upper section, without enlargement of the point below, either by its own partial fusion or by the lodgment of the upper metal upon it.

"2d, Uniting the successive sections of an obliquely sectional lightning rod point, by solder or brazing, which is at each joint fusible at a lower temperature than the section immediately above it, so that the melting of the point shall remove the entire uppermost section, and thus more certainly prevent the lodgment of any portion of the melted section upon the point thus exposed."

21. For an *Improvement in Smut Machines;* Charles and James Keeler, Union, New York, September 14.

"The nature of my invention consists in constructing the wind passages and spouts in

such a manner as to allow of their being turned to either side, to allow the machine to be driven in either direction."

Claim.—"What we claim as our invention is, making the blowing apparatus, with the drawer and spout, movable, substantially as described, so as to allow of the wind-chest and pipe being easily taken out, and turned in either direction, to admit of the machine being driven in whichever direction may be desired."

22. For *Machinery employed in the Manufacture of Coiled Wire Ferrules;* William T. Richards, New Haven, Connecticut, September 14.

Claim.—"I am aware that clamps or holders and cutting dies have been worked by cranks and cams; I therefore do not claim these, as such, as my invention. But what I claim as my invention is, the method of cutting the wire at right angles to the axis of the coil, so that the ends of the ferrules will be perfectly true, without wasting any of the stock, by the use of the short mandrel, the clamp or holder, and the cutting die, when the machine is constructed, arranged, and made to operate substantially as herein described.

"I also claim the combination of the method of cutting the coil (as described above) with the method of supporting the long coil, and of feeding it, and of throwing off the piece when severed, when combined, arranged, and operated substantially as herein described."

23. For an *Improvement in Shuttle Guides to Looms;* Horace T. Robbins, Lowell, Massachusetts, September 14.

Claim.—"I claim as my invention, 1st, The guide or its equivalent, either with or without the flanch, in combination with cloth-weaving looms, or as applied and used therewith, substantially in the manner and for the purpose of guiding the shuttle as specified.

"2d, I claim the spring and finger, or their equivalent, so arranged as to hold the guide in its proper place, substantially as specified."

24. For an *Improved Machine for Manufacturing Porte Monnaies;* Benjamin S. Stedman, West Meriden, Connecticut, September 14.

"This invention relates to certain means of inserting the leather or other material of which the sides of the porte monnaies and other similar cases are made, in their metal frames, by which a great saving in manual labor is effected, and the work performed in a better manner than by the common method."

Claim.—"What I claim as my invention is, 1st, The manner, substantially as described, of putting the leather or other material in the frames, by forcing a sufficient quantity through the frame, with a die or plunger, at the back side, and then by a larger die pressing the part so forced through, and folding it over the inner edge of the frames.

"2d, The form and construction of the clamp, which holds the frame and the leather or material, to wit: the lower part having an opening just large enough to allow the die on the back side to pass through, and the upper part having an opening large enough to allow the larger die to pass through, and fold the leather or material over the frame, and having a recess in its inner or bottom face, around the said opening, to receive and hold the frame in it, so that the leather or material is held independently of the frame, and allowed to be drawn through the frame, substantially as herein described."

25. For an *Improvement in Door Locks;* William Moore, Williamsburg, New York, Assignor to James Carman, City of New York, September 14.

Claim.—"The dividing plate being well known, is public property; therefore, forms no part of my claim: neither do I claim any of the parts operated from the outside key-hole, as these may be of any usual form. But what I claim is, the tumbler, enclosed by the dividing plate, to be operated on solely by the key, when entered from the inner key-hole, in combination with the revolving check, or its equivalent, and the bolt, for the purpose and as described and shown."

26. For *Improvements in Forging Machines;* George H. Richards, West Roxbury, Assignor to Calvin G. Plimpton, Walpole, Massachusetts, September 14.

Claim.—"I claim the sliding guide traversing upon the side bars, as described, having a pin, pivot, or fulcrum, one end of which is attached to the sliding guide, while the other end of the hammer, in which it is so fitted as to allow the hammer to turn a short distance, when power is applied to it by means of the crank, cam, or eccentric and the connecting rods."

27. For an *Improved Alarm Time Piece for Lighting Lamps;* William H. Andrews, Cheshire, and Randal T. Andrews, Plymouth, Connecticut, September 21.

"Our improvement consists in using a longitudinal section of a hollow cylinder, placed vertically in the lower part of the case of the time piece, with the lamp, match, &c., placed in it, so as to be within the case when not in use, but so that when the alarm is let off, the cylinder will be revolved one-half of a circle, the lamp lighted, and presented in front of the case of the time piece, for the convenience of the user."

Claim.—"What we claim as our invention is, the use of a revolving vertical section of a cylinder, when combined with a spring to revolve it, when these are combined with the appropriate levers, and connected with the alarm wheel of an alarm time piece by an appropriate connecting rod, for the purpose of lighting a lamp, in connexion with the alarm given by an alarm time piece, when the whole is constructed, combined, and arranged substantially as herein described."

28. For an *Improvement in Tuning Pegs for Guitars, &c.;* James Ashborn, Wolcottville, Connecticut, September 21.

Claim.—"What I claim as my invention is, making the tuning pegs of guitars and other like stringed instruments, with the journal part of much greater diameter than the barrel on which the string is coiled, substantially as and for the purpose specified."

29. For an *Improvement in Carving Machines;* Charles E. Bacon, Buffalo, New York, September 21.

"The nature of my improvement consists in giving to a vertical or inclined cutter, a motion laterally in any direction, at the same time it has a rapid rotary motion, for the purpose of producing a fac simile of any pattern or device, or for carving or cutting from patterns or originals previously made, or for cutting a pattern or device which shall be the reverse of the original, that is, having projections where there are cavities in the original, and vice versa."

Claim.—"What I claim as my invention is, the folding frame and wheels or pullies, constructed substantially as above described, in combination with the double cross sliding ways and vertically sliding cylinder or tracer, for the purpose of tracing from patterns or other device, in the manner above specified."

30. For an *Improvement in Coating Iron with Copper;* Theodore G. Bucklin, Buffalo, New York, September 21.

Claim.—"Having thus described my invention, I do not claim the preparation of iron with zinc, in the manner described; but I claim, 1st, Coating cast, malleable, or wrought iron, with copper, or any of the alloys of which copper forms a part, by employing a coating of zinc, or zinc and tin, to cover the iron, as a positive medium to make the molten copper or its alloy adhere to the iron, in the manner substantially as described.

"2d, I claim the employment of an infusible or partially infusible substance or substances, especially the fluoride of calcium, as a wiper and non-conductor, as herein set forth."

31. For an *Improved Hand Drilling Machine;* Reuben Daniels, Woodstock, Vermont, September 21.

Claim.—"What I claim as my invention is, the combination of the geared mandrel, which elongates, to feed the drill, with the arm that projects from the sleeve, to steady the gearing, and the slot in the stock, to guide and steady the arm, while traversing therein, to permit the drill to be advanced and withdrawn, as herein set forth."

32. For an *Improvement in Horse Collars;* J. H. Hall and John Lowrey, Wheeling, Virginia, September 21.

"Our invention consists of a metallic framed collar, which can be expanded or contracted to suit horses of different size, and which maintains the parallelism of its sides, however much it is expanded or contracted."

Claim.—"We do not claim a rigid collar, nor a collar capable of expansion and contraction sidewise, when the sides are connected by a third or intermediate part, or supported by a frame; but what we do claim as our invention is, the construction and arrangement of the two sides of the collar, so that they fit together, and can be moved towards and from each other by a parallel motion, to diminish or enlarge the aperture for the horse's neck, and then be fastened by a set screw, or its equivalent, to form a rigid frame, substantially as herein described."

33. For an *Improvement in Portable Wardrobes;* Seth L. Hobart, Hingham, Massachusetts, September 21.

Claim.—"Having thus described my improved wardrobe, what I claim as my invention is, a wardrobe susceptible of dismemberment, with the parts held together by means of the sliding bolts, which fit into sockets, and the notched studs, which fit into the grooves, the top piece preventing the back from slipping by the bolts, and the sides being prevented from slipping by the projecting pieces, which press the braces forward, and keep the studs pressed forward as above described."

34. For an *Improvement in Machinery for Beveling the Edges of Skelps or Metallic Strips &c.;* Robert Knight, Cleveland, Ohio, September 21.

"The nature of my invention consists in the arrangement of rollers in a frame work, so to receive a lateral movement or end play, one over the other, for the purpose of increasing or diminishing the distance between bosses on the rollers, according to the width of the strip or plate of which the flues and pipes are made."

Claim.—"What I claim as my improvement is, arranging the rollers in the frame, so as to receive a lateral movement as may be desired; in other words, giving the rollers end play, one over the other, as thereby increasing or diminishing the distance between the bosses, (according to the width of the plate or strip,) and providing suitable means for retaining the same in place."

35. For an *Improvement in Rakes;* Amza B. Lewis, Brooklyn, Wisconsin, September 21.

Claim.—"What I claim as my invention is, the combination of the slotted, swinging arm with the slotted rake handle and crank, in manner as above described, for moving the cut grain from the platform."

36. For an *Improvement in Paper Cutting Machines;* James E. Mallory, City of New York, September 21.

Claim.—"Having fully described the nature of my invention, what I claim as new therein is, the arrangement of the movable platform and sliding clamp, as described, in combination with the vibrating knife, as described."

37. For an *Improvement in Crayon Rubber;* Daniel F. Pond, New Haven, Connecticut, September 24.

Claim.—"I do not claim as new, the casting of particular forms of vulcanized rubber in moulds; but what I do claim as my invention is, the crayon rubber, made in the manner herein before substantially set forth, for the purpose of applying and blending the crayons in the bi-chromatic and other kindred styles of drawing."

38. For *Application of a Free Joint Tube in circumstances where it is exposed to external pressure;* Richard Prosser, Birmingham, England, Assignor to Thos. Prosser, City of New York, September 21; ante-dated May 31, 1852.

Claim.—"What I claim as my invention is, the application of the improved metal tube made in the manner and for the purposes as herein before described, that is to say, of a metal tube with a free joint, (neither welded nor brazed,) to boilers of steam engines or other vessels requiring metal tubes, of such a character as to resist external pressure effectually."

39. For an *Improvement in Galvanic Clocks;* Moses G. Farmer, Salem, Massachusetts, Assignor to himself and Charles C. Coffin, Boscowen, New Hampshire, September 21.

Claim.—"What I claim as my improvement or invention is, the combination of the impulse spring and the pallets, respectively connected with the armature of the magnet and the pendulum, and made to operate together, and to make the pendulum operate or impart impulse to it, substantially as described."

40. For an *Improvement in Shoes and Gaiter Boots;* Joseph Brackett, Swampscott, Massachusetts, September 28.

Claim.—"What I claim as my invention is, the improved gaiter boot or shoe, as made with a lap piece separate from both the quarters, and extended up from the instep part of it, in combination with so applying button holes and buttons, or their equivalents, to the said lap piece and the two quarters, as to enable the two quarters to be directly connected by the lap piece, all substantially as above specified."

1. For an *Improved Jointed Bed Plate Saw Gummer;* Hosea O. Elmer, Mexico, New York, September 28.

"The nature of my invention consists in the combination of a cylindrical cutter, having rotary motion, and placed on a frame having a reciprocating and rectilinear motion, with jointed bed, within which the saw to be filed and gummed is clamped, by which combination both the under and inclined faces of the teeth are filed perfectly true, and the saw gummed and jointed."

Claim.—"I do not confine myself to any particular mode of doing this, viz: supporting the bed piece; nor do I confine myself to the particular mode of construction of the several parts as herein described, but any other method substantially the same, so long as the bed piece is jointed, and one part capable of being clamped, when in line, or at an angle with the other part; I do not claim the cylindrical cutter separately, as that has been previously used. But having thus described the nature of my invention and the manner in which it is operated, what I claim as new is, the employment or use of the cylindrical cutter, the said cutter having a rotary and also a reciprocating rectilinear motion, in combination with the jointed bed piece, in which the saw is placed, the cutter having the above motions communicated to it in the manner as described, or in any equivalent way, and the bed piece being constructed substantially as shown and described; by which combination, saws may be filed, gummed, and jointed, in an expeditious and proper manner, as set forth."

2. For an *Improvement in Piano Forte Action;* George Howe, Boston, Massachusetts, September 28.

Claim.—"Having described my improvement in piano forte action, what I claim as my invention is, jointing the fly of the jack to the stem of the same, so as to constitute a lever, the short arm of which has to move but little distance before it strikes against the regulating button, for the purpose of preventing any noise or "slapping," as above set forth."

3. For an *Improvement in Throstle Spinning Machines;* Charles H. Hunt, Lawrence, Massachusetts, September 28.

Claim.—"What I claim as my invention is, the escapement wheel, O, its escapement lever, (composed of the arm, *h*, and pallets, *i k*,) and stud, *y*, in combination with the reciprocating rotary mechanism, composed of the wheel, P, its concentric and endless grooves, row of pins, the pinion, *p*, and pendulous bar or arm, *r*; the whole being applied to give motion to the shaft, N, its pinion, the gear of the shaft, K, and the said shaft, K, in order to effect the movements of the spindle rail or rails, essentially as above specified."

4. For an *Improvement in Saw Mills;* Hazard Knowles, City of New York, September 28.

Claim.—"Having fully described my improvements in saw mills, what I claim therein as new is, the adjustable ways of the saw gate, when they are connected with each other in such manner, that they can be simultaneously and uniformly raised and adjusted in their positions, whilst the saw gate is in motion, for the purpose of varying the amount of the cutting action of the saw, substantially as herein set forth.

"I also claim the connecting and arranging of the feeding apparatus with the saw gate, and the adjustable ways thereof, in such a manner, that the feeding motion communicated to the material operated upon, will invariably be in perfect harmony with the cut of the saw, and also in such a manner as will enable me to ease the action of the saw, when passing through knots, and at any time adapt it to the nature and the depth of the material operated upon, substantially as herein set forth."

5. For an *Improvement in Brick Kilns;* Richard E. Schroeder, Rochester, New York, September 28.

Claim.—"Having fully described the construction and operation of my improved kiln, in the several processes of burning brick, I would state that I do not claim constructing a stationary kiln of masonry; but what I do claim as my invention is, so arranging the several compartments of the kiln, each provided with a fire place, in a circuit, and connecting them with each other and with the fire places and chimnies, by means of flues and dampers, that one compartment after another may be charged with fresh brick, and the brick be successively dried and heated by the waste heat, burned, cooled down, and removed, substantially as in the manner herein fully set forth."

46. For an *Improvement in Lath Machines;* Henry C. Smith, Cleveland, Ohio, September 28.

"The nature of my invention consists in turning the log or bolt from which the laths are to be cut, by means of poppet heads or wheels, arranged and operated at each end of said log or bolt, and driven by the same first moving power, or so as to have the same relative velocities, by which means all wrenching or twisting of the log upon its centre is entirely obviated, and it is firmly held up to the knives to be operated on it; and also in combining therewith the detachable dogs and hollow mandrel, for the purpose of clutching or releasing the log or bolt, and for centreing said bolt before it is placed upon the mandrels."

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, the combination of the method of rotating the log or bolt from which the laths are to be cut, by means of the poppet wheels, arranged respectively on the shafts, and forms a part of the mandrel at each end of the log, and the gear wheels, or their equivalents, moving with equal velocities, so as to prevent any wrenching or twisting of the log on its centres, and to hold it firmly up to the knives whilst being operated upon by them, and the method of clutching and releasing the log, by means of the dog, hollow bearing for containing the clutch head, and hollow shaft for receiving the rod, which screws into said clutch, and by which the dog may be driven into the log, or the log released; the whole being arranged and operating substantially in the manner and for the purpose set forth."

47. For an *Improvement in Sounding Boards of Piano Fortes, &c.;* Alfred Speer and Ernest Marx, Aquackanock, New Jersey, September 28.

Claim.—"What we claim as our invention is, making the sounding board of a piano forte, or other stringed musical instrument, and arranging the strings and all appendages thereto, in the form of a cylinder, or part of a cylinder, or in any of the forms we have mentioned, as considered to be equivalent; the said board having its ends secured between two disks or heads, and having no other support, except that derived from the said disks or heads."

48. For *Improved Machinery for Forming Sheet Metal Tubes;* Orson W. Stow, Southington, Connecticut, September 28.

Claim.—"I do not claim the manner of forming tubes by means of a rod and concave bed, irrespective of the manner of operating the rod, for they have been previously employed, the rod being operated or driven in the bed, by means of a mallet or hammer, operated by hand, or by means of levers or cranks moved by gearing. What I claim, therefore, as my invention is, 1st, The method of mounting and operating the rod within the concave bed, in the manner as shown and described, viz: the ends of the rod being attached to the slide rods, and slide rods passing through the vertical guides, and having spiral springs around them, the lower ends of the slide rods being attached to levers, by operating which the rod is forced within the concave bed, and the lower portion of the tube formed.

"2d, I claim the hinged folders attached to the wings, which are hung on points, said points being in line longitudinally with the centre of the rod, and operated in the manner and for the purpose of forming the upper or remaining portion of the tube, as herein set forth."

49. For an *Improvement in Registers for Omnibuses and for other purposes;* J. Z. A. Wagner, Philadelphia, Pennsylvania, September 28.

Claim.—"What I claim as my invention is, fitting toll passages with a registering step, combined with mechanism, in such manner, that the aggregate number of full and fractional tolls due from passengers will be reduced to the denomination of full tolls, and registered, whatever the proportions may be in which the aggregate is composed of fractional and full tolls, substantially as herein set forth."

50. For an *Improvement in Bellows for Reed Instruments;* Isaac T. Packard, Campello, Massachusetts, September 28.

Claim.—"What I claim as my invention is, the employment in all reed instruments of bellows, having two chambers, in one of which a vacuum is produced, and in the other air is compressed, the said chamber being on opposite sides of the reeds, and communicating with each other through the reeds, so that when one forces air through them, the other, by the vacuum, draws it through at the same time; this I claim without reference to the precise construction of the bellows, or the mode of operating them."

51. For an *Improvement in Electro-Magnetic Engines;* John S. Gustin, Trenton, New Jersey, September 28.

"The nature of my invention consists in the arrangement of a pump and electro-magnets attached to a lever or working beam, with the several parts so adjusted with spring and pendulum, that by the application of a galvanic battery the pump is put in motion, and continues its work steady, without requiring the aid of personal attention, except that which is necessary to replenish the acids in the battery when exhausted."

Claim.—"What I claim as my invention is, the application of a spring or springs, or their mechanical equivalent, used as recipients of the excess of power in the closing of the electro-magnets and armature, to be imparted again to the next, as described and set forth."

52. For an *Improvement in Machines for Polishing Leather;* John M. Poole, Assignor to J. Pusey and James Scott, Wilmington, Delaware, September 28.

Claim.—"What I claim as my invention is, 1st, connecting or fastening the stand or stands that hold the polishers or burnishers to a belt, so as to traverse them in ways or grooves, or under a plane, substantially as described."

Designs for September, 1852.

1. For a *Design for a Medallion of General Scott;* Peter Stephenson, Boston, Massachusetts, September 7.

Claim.—"What I claim is, the design of a medallion of Winfield Scott, as represented in the drawings above referred to."

2. For a *Design for a Medallion of Franklin Pierce;* Peter Stephenson, Boston, Massachusetts, September 7.

Claim.—"What I claim is, the design of a medallion of Franklin Pierce, as represented in the drawings above referred to."

3. For a *Design for a Coal Stove;* William L. Sanderson, Troy, Assignor to R. Finch, Sr., and Reuben R. Finch, Jr., Peekskill, New York, September 7.

Claim.—"What I claim as my invention is, the within described design, configuration, and general arrangement of the forms, ornaments, and mouldings upon the stove as a whole, and upon the following parts individually: the side, back, and front plates; doors; bottom plate; top plate and cover; feet; water vase; cover and front of ash pit; the whole being shown in the accompanying drawings."

4. For a *Design for a Cooking Stove;* Samuel D. Vose, Albany, New York, September 14; ante-dated March 14, 1852.

Claim.—"I do not claim any detailed part of the mouldings or configuration. What I claim as my invention is, the general combination of the several mouldings and ornaments, as arranged together, the whole forming an ornamental cooking stove, as herein set forth and described."

5. For a *Design for a Parlor Stove;* Conrad Harris and Paul W. Zoiner, Cincinnati, Ohio, September 14.

Claim.—"What we claim as our invention is, the combination of the scrolls and foliage, arranged as set forth in the annexed drawing, so as to form an ornamental design for parlor stoves; to be known and called the Cottage Franklin."

6. For a *Design for a Cook Stove;* Samuel D. Vose, Albany, New York, September 14.

Claim.—"I do not claim any detailed part of the mouldings or configuration. What I claim as my invention is, the general combination of the several mouldings and ornaments, as arranged together, the whole forming an ornamental air-tight cook stove, as herein set forth and described."

7. For a *Design for a Cook Stove;* N. S. Vedder, Troy, New York, September 14.

Claim.—"What I claim as new is, the ornamental design and configuration of cook stove, the same as herein described and represented in the annexed drawing."

8. For a *Design for a Parlor Stove;* James J. Dulley, Assignor to Johnson, Cox, and Fuller, Troy, New York, September 14.

Claim.—"What I claim as new is, the ornamental design and configuration of stove plates, the same as herein described and represented in the annexed drawings."

9. For a *Design for a Camera Stand;* W. A. Allen, City of New York, September 21.

Claim.—"What I claim is, the design and configuration of the several ornaments, forming in combination an ornamental stand for cameras and other purposes, as described and set forth."

10. For a *Design for a Wire Fence;* Francis Kilburn, Lancaster, Pennsylvania, September 21.

Claim.—"What I claim as my invention is, the design of a wire fence, ornamented as herein described and shown in the accompanying drawings."

11. For a *Design for a Cooking Stove;* Orin W. Andrews, Providence, Rhode Island, Assignor to Isaac Backus, Canterbury, and John Pitt Barstow, Norwich, Connecticut, September 21.

Claim.—"What I claim is, the design and configuration as herein shown of the stove as a whole, and of the front, back, and side plates severally."

OCTOBER.

1. For an *Improvement in Grain Separaters;* Jacob Bergey, Wadsworth, Ohio, October 5.

"The nature of my invention and improvement consists in the manner of sustaining the inclined revolving perforated cylinder, by anti-friction wheels, upon whose peripheries the cylinder turns, it being prevented from descending below its required level by circular or ring projections, or flanches, secured to the exterior of the cylinder, and turning against the sides of the wheels, which themselves turn on short studs or axles inserted into the frame of the machine."

Claim.—"Now, I am aware that revolving screens, separately considered, are not new; also, that the conveyer, or endless apron, has been employed, in combination with a threshing cylinder, vibrating shoe and fan, and therefore, of themselves, I do not claim: but what I do claim as new is, the use of a hollow revolving cylinder, so constructed and so moved, as herein fully set forth, for the purpose of a straw carrier, by which the advantages above enumerated and explained are obtained."

2. For an *Improved Vice;* William Butler, Little Falls, New York, October 5.

Claim.—"What I claim as my invention is, the arrangement of the sliding bar with the screw attached thereto, with reference to the fast jaw, *a*, and the moving jaw, *b*, when said sliding bar is provided with a series of holes, or their equivalents, and said jaw, *b*, is provided with a pin, or its equivalents, whereby *b* can be set at varying distances with respect to *a*, and that distance afterwards regulated by the screw."

3. For an *Improvement in Hand Printing Presses;* Charles Foster, Cincinnati, Ohio, October 5.

Claim.—"Having described my improvements in printing presses, what I claim as new are, 1st, The arrangement, substantially as described, in a hand power press, of guide bars resting upon adjusting points, or hinged at their rear ends, and guided at their front ends to a vertical vibration, concentric with said points or hinges, so that the entire bed, guide bars and their appendages, shall move bodily upward upon giving the impression, and return by their own weight to the state of rest, whether operated by a shaft extending below the bed, and working a toggle joint beneath the bed or bars, as described, or in any equivalent way.

"2d, I claim, in connexion with the before described arrangement, the ascending grade at the fore end of the guide bars, for the purpose of limiting the range of the toggle at the period of giving the impression."

4. For an *Improvement in Seed Planters;* D. Haldeman, Morgantown, Virginia, October 5.

"The nature of my invention consists, 1st, in having the wheel or roller encompassed by one or more tyres, which may be adjusted to the wheel or roller at pleasure, thus increasing or diminishing the diameter of the wheel, and allowing the seed to be planted the required distance apart, as will be hereafter shown."

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, the employment or use of the adjustable tyre or tyres, for the purpose of varying the diameter of the wheel, to allow the seed to be deposited the required distance apart."

5. For an *Improvement in Rotary Stove Grates;* Alexander Harrison, Philadelphia, Pennsylvania, October 5.

Claim.—"What I claim as my invention is, 1st, The combination of the rotary movement of the bottom grate with the vertical annular grating, or its equivalent, surrounding the same, for the purposes substantially as herein set forth.

"2d, I claim the rotary movement of the bottom grate with the controlling tilting movement of the same, substantially as herein described.

"3d, I claim the combination and arrangement of the several parts, whereby the aforesaid rotary and tilting movements of the bottom grate are effected, substantially as herein described."

6. For an *Improvement in Seed Planters;* Robert M. Jackson, Penningtonville, Pennsylvania, October 5.

"The nature of my invention consists in applying a sieve to the machine, which will deposit the fine earth upon the grain, and throw the coarser parts to each side, and a marking rod, by which corn may be planted, to be in rows across as well as lengthwise."

Claim.—"What I claim as my invention is, the corn planter sieve and its appendages, for the purpose of sifting and depositing the fine earth upon the grain, and throwing off stones and such matter as would obstruct the young sprout in coming through the ground, substantially as described and illustrated herein."

7. For an *Improved Spark Arrester;* Volney P. and B. Kimball, Watertown, New York, October 5.

Claim.—"Having described the nature of our invention and the manner in which it is operated, what we claim as new is, the revolving screen, in combination with the chamber, the lower part of said chamber communicating with the smoke pipe at a point below the tops of the exhaust tubes, by which arrangement a downward draft is created within the chamber, and the cinders drawn from the screen as it revolves, thus preventing the clogging of the screen, as set forth."

8. For an *Improvement in Bee Hives;* Lorenzo L. Langstroth, Philadelphia, Pennsylvania, October 5.

Claim.—"What I claim as my invention is, 1st, The use of a shallow chamber, substantially as described, in combination with a perforated cover, for enlarging or diminishing at will the size and number of the spare honey receptacles.

"2d, The use of the movable frames, or their equivalents, substantially as described; also, their use in combination with the shallow chamber, with or without my arrangement for spare honey receptacles.

"3d, A divider, substantially as described, in combination with a movable cover, allowing the divider to be inserted from above between the ranges of the comb.

"4th, The use of the double glass sides in a single frame, substantially as and for the purposes set forth.

"5th, The construction of the trap for excluding moths and catching worms, so arranged as to increase or diminish, at will, the size of the entrance for bees, substantially in the manner and for the purposes set forth."

9. For an *Improvement in Upright Piano Fortes;* R. E. Letton, Quincy, Illinois, October 5.

Claim.—"What I claim as my invention is, 1st, extending the upper part of the metallic plate or cap, at the part where the shorter of the strings are placed over the sounding board, and supporting it by blocks or supports, which pass through the sounding board to the frame timbers, substantially as set forth, whereby the higher end of the bridge, or that part on which the strings of the higher notes rest, is allowed to be brought nearer to the centre of the sounding board, to get a better vibration.

"2d, The combination, in the manner substantially as described, of the cushioned block and the adjustable button on the upright wire attached to the key, for the purpose of preventing the entire descent of the hammer, after striking, until the key is left free."

10. For an *Improvement in Machines for Wringing Clothes;* Joseph P. Martin, Philadelphia, Pennsylvania, October 5.

Claim.—"Having fully described my invention, what I claim as new is, keeping the ends of the clothes sack distended, during the progress of wringing, to equalize the twisting of the same at all parts, by means of the elliptical spring leaves and elastic wings, substantially as described."

11. For an *Improved Apparatus for Puddling Iron, &c.;* James M'Carty, Reading, Pennsylvania, October 5.

Claim.—"Having described my automatic puddling apparatus, what I claim as new is, 1st, the combination of an automatic rable, with a revolving or moving basin, arranged and operated substantially as herein set forth, or with a stationary basin, or bottom, whereby much manual labor is dispensed with, for stirring the iron in the process of puddling.

"2d, The arrangement of the hollow shaft, cooler, and moving basin, in such manner that a stream of water can be kept circulating round the bottom and sides of the latter, to prevent it from being overheated, substantially as herein described.

"3d, The combination of the crank and swinging guides, or their equivalents, which enables the operator to make the rable stir over different parts of the bottom, and at different angles to the side of the furnace, and also to remove it out of the way when necessary."

12. For an *Improvement in Piano Fortes;* James and John McDonald, City of New York, October 5.

Claim.—"What we claim as our invention is, 1st, the combination of the wind chest and flute, or other similar wind pipes, with the horizontal piano forte action, in the manner substantially as set forth, to wit: the pipes being placed horizontally at the bottom of the case below the piano forte action, and the wind chest placed below the front ends of the piano forte keys, in such a manner as to allow the valves to be operated directly by the said keys.

"2d, The manner of opening the valves of the flute, or wind pipes, to play an octave lower than the piano, either at the same that they are being played at the same pitch as the piano, or not, by means of the series of levers arranged and operated upon by the blocks upon the vertical pins, under the piano key."

13. For an *Improvement in Printing Presses;* John G. Nicolay, Pittsfield, Illinois, October 5.

Claim.—"Having fully described my rotary cone printing press, what I claim as new is, not the use of conical impressing cylinders, but the peculiar arrangement and combination of conical impressing cylinders, one or more in number, each provided with a set of conical distributing inking rollers adapted thereto, and with a rotary wheel or disk, substantially as described.

"I also claim, in combination with the conical impressing cylinders, the position and arrangement of the clamp consisting of the metal plate, spring, and arm or lever, which retains the paper at the required angle to receive the impression, and release the same when the impression is taken, substantially as set forth."

14. For an *Improvement in Expanding Window Sashes;* Mighill Nutting, Portland, Maine, October 5; ante-dated June 16, 1852.

Claim.—"I am aware that window sashes, wide enough to fill the window frames for which they were designed, and which, therefore, could not be put in or taken out, without removing the stop strips, have had grooves made in their edges, to receive spring packing to make their joints tight.

"I am also aware that grooves have been made in window frames, and fitted with spring packing, to press against the edges of the sash, to make the joints tight.

"I am also aware that expanding window frames have been made, and the sashes fitted to them, in such manner, that the ordinary stop strip is not required, and that these frames expand to allow the sash to be taken out, and contract to hold the sash in place after it is reinstated.

"I am also aware that this mode of allowing the sash to be put in and taken out is objectionable, because of its cost and its inapplicability to windows of the common construction now in houses, which could not be modified so as to embrace it, without great inconvenience, damage to the plaster of the walls, &c.

"To none of the foregoing contrivances do I lay any claim; neither would I patent or use them, if I were the first who invented them, because of the superior simplicity, cheapness, and utility of the window described, in which I claim as my invention the sash, constructed in two pieces, so that both, when brought together, shall be narrower than the distance between the bottoms of the grooves in the jambs of the frame in which the sash is designed to be placed, by at least the thickness of one of the stop strips of the frame, and connecting these two pieces of the sash in such manner that one will slide past or into the other, so that the sash can be contracted or expanded, as may be required, to make it fit different window frames, and to adapt itself to the varying width of the same

frame, and also to admit of its being put into and taken out of the frame, without removing the stop strips therefrom; the two parts of the sash thus moving towards and from each other, having springs, or the equivalent thereof, adapted to them, so as to give them a constant tendency to diverge from each other, that the sash may at all times expand promptly, and fill the frame, to hold itself firmly in place, substantially as herein described."

15. For an *Improvement in Milling Machines;* William H. Robertson, Hartford, Connecticut, October 5.

Claim.—"What I claim as my invention is, the construction and combination of the vertically moving cutter stock, or poppet head, with the driving pulleys, &c., mounted on a swinging frame, hung with a pivot hinge at the bottom, the connexion between the two being effected by radius rods, in the manner and for the purpose substantially as herein set forth and described."

16. For an *Improvement in Method of Priming Fire Arms;* Christian Sharps, Hartford, Connecticut, October 5; patented in England, April 22, 1852.

Claim.—"What I claim as my invention is, the priming of fire arms, by throwing a pellet of percussion or priming material over the nipple, at the time the cock is descending thereon, so that the priming shall be struck down in its flight between the cock and the nipple, and exploded."

17. For an *Improvement in Window Frames;* Henry Clay Smith, Portland, Maine, October 5.

Claim.—"What I claim as my improvement is, the pulley style, constructed of the pieces as set forth, in combination with the springs, by which means I am enabled to make use of solid or immovable bead strips and bands, and to remove the sash at pleasure from the frame, in the manner substantially as described."

18. For an *Improvement in Time Pieces;* Silas B. Terry, Plymouth, Connecticut, October 5.

Claim.—"What I claim as my invention is, 1st, hanging the balance of a clock or time piece on a spring or strip of metal, which is fixed, or prevented from turning, at both of its ends, but capable of twisting between the ends, substantially as and for the purpose herein described.

"2d, Making one part of the fork or crutch wire flat and thin, substantially as shown at *k*, or otherwise constructing it, to allow it to bend or move in a similar manner, and connecting the said fork or crutch wire with the balance, in any manner, as shown at *i*, which causes it to give its impulse in the same direction as the motion of the balance, the said bending or motion of the fork or crutch, being for the purpose of allowing it to transmit the impulse in the above direction."

19. For an *Improvement in Churns;* Lucian A. Brown and Hubbard Bigelow, Assignors to Henry K. W. Welch, Hartford, Connecticut, October 5.

"The nature of our invention consists in the construction of the churn, in such a manner as to increase the agitation of the cream to be converted into butter, and the adaptation of the churn for "working" the butter after being made, or in other words, extracting the butter-milk and watery parts extant in butter, thereby rendering it more compact and 'firm,' and less liable to become 'rancid.' "

Claim.—"Having thus described our apparatus and its operation, what we claim as our improvement and invention is, the combination of the tub, including the appendages described, with the frame and stands, or any other convenient frame work adapted to the use of the tub, in a vertical and horizontal position, but in manner and for the purposes substantially as herein set forth and described."

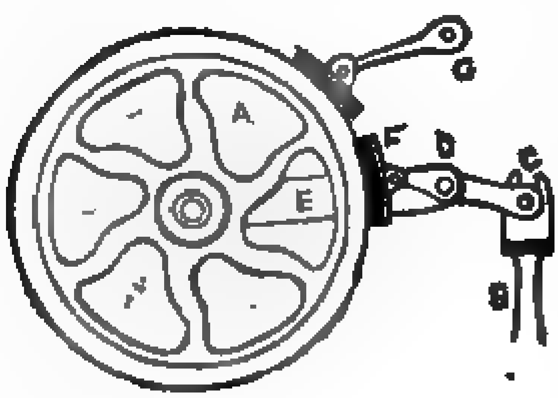
MECHANICS, PHYSICS, AND CHEMISTRY.

*Infinitesimal Taking-up Motion for Power Looms.**

Under a recently specified patent for the improved "manufacture of textile fabrics," Mr. Harrison, the well known machine maker of Black-

* From the London Practical Mechanic's Journal, July, 1852.

burn, has described a new "taking-up motion," which has often occurred to ourselves as a most desirable plan for the purpose. Instead of the common ratchet wheel and catches, a small drum or pulley, having its periphery roughened by diamond lines, is used, this drum being actuated by a duplex lever and friction block, on the principle of the friction windlass movements for ships. Our figure represents the apparatus in side elevation. A is the friction pulley, to be driven by the vibration of the rod, B, in any convenient way. This rod is jointed at C, to a short double lever working on a centre at D, in the end of a longer lever, E, which oscillates freely on the stud-centre of the pulley, A. The opposite end of the lever, C, D, has jointed to it a segmental block, F, faced with leather, to work against the pulley's roughened surface. At G is a fixed centre, to which is hinged a detent lever, having a joint friction block like that just described.



As the rod, B, rises, it is easy to see that the species of knee-joint action of the lever, C, D, will cause its friction block to press firmly on the pulley, which is thus carried round as far as the traverse of the rod, B, permits. During this action, the detent lever, G, being set at an angle with a radial line from G to the pulley centre—the reverse of that of the lever, C, D—will allow its block to slip like the back action of an ordinary ratchet detent. As the rod, B, descends for a second stroke, its lever block slips back, whilst that of the detent, G, holds. By the adoption of this movement, the increments of movement of the pulley, A, are not governed by any definite measure, as in the ratchet teeth of the common wheel; and therefore, whatever minute changes are made in the traverse of the rod, B, such change will be accurately conveyed to the pulley, A.

Mr. Macdowall, of Johnstone, has proposed a contrivance of a similar nature for obtaining a silent and minutely adjustable feed for the timber carriage of saw mills. In this, as well as our own adaptation of it to power looms, the pulley is made perfectly smooth, the friction blocks having smooth segmental metal surfaces; for it appears to us that the elastic cushion must, to a certain extent, defeat the great point of the invention—the direct conveyance of the minute changes in the vibratory movement of the driver.

Mr. Harrison effects the required variation in the driver by the increase of the diameter of the cloth beam, in a manner very similar to that adopted by Mr. Milligan. He has also so modified the common ratchet movement, that it is capable of effecting very minute increments of take-up. He does this somewhat on the principle of the "stepped" spur wheel, by using, say 7 catches hung on one centre, and placed parallel to each other, and increasing in length from 1 to 7 by regular gradations, the distance from the end of the first to the end of the seventh being equal to the pitch of the ratchet wheel, which they actuate. By this means the ratchet wheel may be moved to so slight an extent as one-seventh of a tooth, as each tooth is acted on by each individual catch in succession. Precisely

the same effect is produced by using a "stepped" ratchet wheel, that is, a wheel with several sets of teeth arranged obliquely, or in steps across its periphery, as in the wheel and pinion arrangements of screw steamers, one broad catch only being capable of working the whole series.

Hints on the Principles which should regulate the Forms of Boats and Ships; derived from original Experiments. *By* MR. WILLIAM BLAND, *of Sittingbourne, Kent.*†

Continued from page 277.

CHAPTER XIII.

Having completed some of the most necessary experiments relative to ships, as a supply of materials for the foundation of the superstructure, a brief recapitulation of the conclusions, before entering upon the construction of a boat or ship upon the principles proved essential to be observed, will, it is considered, simplify proceedings, and therefore be next entered upon.

Of the Resistance of Water against the Head of a Vessel.—With a square and perpendicular bow, the resistance is directly as the surface.

Of Weight—its Effects when placed in a body floating on Water.—The resistance of water against any increase of weight is directly as the weight.

Of Lateral Resistance.—The centre of lateral resistance is exactly at the mid-length point of the keel of a ship when floating level, and at rest; but not otherwise: for when in motion, the head or bow meeting with greater resistance from the water than any other parts, the centre of lateral resistance will be moved proportionately forward.

Stability.—This acts when the width is increased one-half, or nearly the cubic ratio; but not afterwards, being as 2, 7, 14, 22. And when the length is added to, the law of stability, if the dimensions be doubled, operates in the proportion of 1 : 3; then, the same quantity of length being continually annexed, it takes the arithmetic ratio. Again, the height or thickness of a body being alone varied, the law of stability operates most when the depth, measured from the line of flotation on the parallel-sided body, equals one-fifth of the width, the centre of its gravity being on a level with the surface of the water.

The Form of the Bows.—The conclusions are, that the sharper the form of the bows, the less is the resistance from water; and if gentle horizontal curves be substituted for horizontal straight lines on the sides of the bows, the speed will be improved.

The Bevelling-up of the Bows.—The effects of the bevelling-up of the bows are in favor of speed by diminishing resistance.

The Bevelling-up of the Stern.—The tapering of the sides throughout the greater length of the body of a ship is detrimental to speed; but if it be commenced at the midship section, and the reduction moderate and a curve, the advantage will be great. The same benefit results when the bottom is gently curved up from the midship to the bows; and, indeed, the effect exceeds that towards the stern.

• From the London Civil Engineer and Architect's Journal, October, 1851.

Of the Length of Ships, all having the same Bows and Beam, and equal in Weight.—The result obtained is, if equal increment of length be tested, equal advantages will be obtained on the side of the equal increments.

The Form of the Midship Section.—As regards speed, the semi-circular form possesses the most, and the triangular one the least. Again, the flat bottom floats the shallowest, and the triangle the deepest, being double that of the former when of equal weight.

Lee-Way.—This property in a ship depends directly upon its perpendicular depth and length at which it is immersed whilst floating upon the water.

Of Floating Bodies Varied in their Dimensions.—It appears that the shallower the same weight can be supported upon water, the less the resistance as regards speed; consequently, extended surface of bearing to a certain degree is advantageous towards facilitating progress, and which a moderate curve always imparts. But where an extension of surface-bearing can be obtained without loss of speed, stability becomes directly increased, which is a gain in power to vessels impelled forward by the wind, as it admits of a proportionate increase in the breadth of sail, therefore of speed.

Whilst carrying out these particular experiments, it appeared, if the angles exposed in any way to the water were rounded off, greater speed ensued; but it was generally at the expense of stability, and decidedly so if the pro-sections be low, because the greater is the length of lever from the centre of motion.

Curves were found to favor speed in comparison with straight lines; consequently, the latter are to be avoided as much as possible wherever speed is the object, and the oar and steam are to be the moving powers.

With respect to the general form of ships, experiment decides most positively that the bird or duck species affords the true models for comparison and study, since the forms of fish are so exceedingly various.

Chapter XIV.

Much has been said upon the comparative speed of several models, likewise of their stability. Now, as stability forms the basis of the power by which the wind, acting upon sails, impels forward the body of a vessel, it will be right to take into consideration and calculation these respective qualifications, as possessed by some few of the models which have been tested. Before doing so, however, since it is evident that those models which equalled or surpassed their competitors in speed, and at the same time had greater stability, will always, under the same weight, run away from vessels of less stability; and if admitted, it will be necessary only to investigate the more extreme cases of both speed and stability, with the exception of one or two instances, when the merits of all the rest follow as a matter of course.

From what has been already ascertained, it appears that when two models of equal weight and similar outline, but one longer than the other, the former invariably had the advantage in speed; consequently, in the following investigations, the calculations had best be confined to models of the same length, but varying in their dimensions of breadth; their weights when tested against each other being always made equal.

Since the models of 28 inches in length are the largest which have been employed, and from their variety of form, though only few in number, they may in fairness be selected for the requisite calculations.

First.—Let the model I, in experiment 72, be selected, which is of the bird or wild fowl shape, 4 inches wide and 28 inches long. This, when tested with the model O, in experiment 79, also of the bird form, whose breadth is 5¾ inches, length 28 inches, and the weight 2 lb. 5 oz., gave the following result: the model I, beat in speed the model O, by 12 oz. extra weight. The stability of I, equalled 2½ oz., and that of O, 8 oz.

Now the 12 oz. extra weight may be called one-third of the whole weight moved, being 2 lb. 5 oz. The stability of O, which represents the power of carrying sail, is superior to that of I, in the proportion of 32 : 10, or 3 : 1; therefore say two, which is 74 ounces over and above the model I. This sum is to be set against the one-third of the extra weight of 12 oz., or speed of I, and gives the balance of speed, the sails of each being proportional to their respective stabilities, greatly on the side of O, and equal in ounces to 74—12, or 62 ounces.

The draft in the water of these models, each laden with the extra 12 oz., making 49 oz., was in the model I, 1⅛-inch deep; and in O, ¾-inch; thus proving the boat with greater breadth of beam would, under canvas, be decidedly the best boat of the two.

Second.—The next models for comparison are O and P, in experiment 80. These were both 5¾ inches wide, 28 inches long, and each of the weight of 3 lb. 4 oz. In this instance, O proved superior in speed to P by 2 lb. 5 oz. extra weight. The stability of O now equalled 8½ oz., and that of P 12 oz. The extra weight of 37 oz. equalled, say two-thirds of the weight moved.

The stability of P is not quite one-half more than that of O, but let it be so, which sum, if denoted by ounces, will equal 26 oz., and this set against the 37 oz., the extra speed of weight of O, will give the superior speed. When both are placed under sails proportionate to their respective stabilities to the model O, and in ounces equal to 37—26=11 oz., meaning when P and O are moving under sail with their speeds equal, O will carry at the same time 11 ounces more than P.

The draft in the water of these two models, when of equal weight, and each having the extra 37 oz., or total of 74 oz., was in O $1\frac{1}{18}$-inch, and in P ⅞-inch.

Third.—The model P again made use of to test the model Q, in experiment 81. The dimensions, &c., of P are, width 5¾ inches, length 28 inches, weight made equal to 3 lb. 4 oz. The dimensions of Q are, width 8 inches, length 28 inches, weight 3 lb. 4 oz. The result, as stated in experiment 82, was 20 ounces, which P carried extra to cause its speed to be equal with the model Q. The stability of P equalled 12 oz., and that of Q 21 oz. The extra weight of 20 oz. is two-fifths of 52 oz., the weight of the model. The stability of Q is just one and three-quarters of P, or above that of P by three-fourths of 52, which when reduced to ounces, will be 39, and set against the two-fifths of the extra weight or 20 oz., will give the balance of speed on the side of Q, equal to 19 oz.

These two models, P and Q, sank in the water when each was loaded with the additional weight of 20 oz., or total 72 oz.,—viz: P $\frac{7}{8}$-inch, and Q 1 inch.

The conclusion arrived at is, the superior stability of Q enables it to have the advantage in speed over P, each carrying sail proportionate to their stabilities.

Fourth.—From the marked speed of G over P, it will be right to compare its qualities with those exhibited in Q. It has been already shown that the speed of O beat the speed of P by 37 oz.; and P beat Q by 20 oz.; therefore, it will require the sum of the two, or 37+20=57 oz. extra weight placed in O to retard its speed till it equals that of Q. The weight of each, as before given, equalled 52 oz.; therefore, the extra weight of 57 oz. exceeds it by 5 oz. The stability of O equalled 8$\frac{1}{4}$ ounces, and that of Q 21 oz., without the 57 oz. extra. From the above it appears that O has the advantage in speed equal to more than the weight moved; and Q has the excess of stability above O equal to one and a-half its stability; which being reckoned in ounces equals 52+52—3 oz., the deficiency=75 oz.; but the extra weight of 57 ounces when taken from 101 oz., leaves 18 oz. in favor of Q, the model with the greatest breadth of beam.

The depth or draft in the water of the models when under the double extra weight of 37+20, or 57 oz., making the total weight of each 109 oz., was in model O, 1$\frac{5}{8}$-inch, and in Q, 1$\frac{1}{8}$-inch. The model Q, from its great breadth of beam, would beat the model O, provided, as before mentioned in the preceding cases, the surface of the canvas be proportionate to their stabilities.

Fifth.—In experiment 82, the model Q was tested against R. The dimensions of Q are 8 inches in width, 28 inches long, and the weight 5lb. 1 oz.; and those of R, 11 inches wide, 28 inches long, and weight, 5lb. 1 oz., also. Likewise, it is there shown the model Q beat in speed the model R, by 4 oz. extra weight. The stability of Q equalled 24 oz., and that of R 29 oz.

The extra weight of 4 oz. is one-twentieth of 81 oz., and the stability of R exceeded that of Q by 5 oz., which is rather more than one-fifth of 24; and, estimated in ounces, will, in 81 oz., the weight moved, equal 16 oz.; and, minus the 4 oz. extra weight, the measure of the superior speed of Q, leave 12 oz. as the advantage, ultimately, of R over Q. Admitting the above to be correct, then R, under sail, and of equal weight with Q, will beat that, or any other of the same length, but having the beam of less dimensions. The two models, Q and R, sank in the water $\frac{7}{8}$-inch when of the same weight and with the addition of the 4 oz. extra, or total 85 oz.

Sixth.—In experiment 83, the model Q was tested against T, the dimensions of these two boats being the same in width, length, and weight. The result of their speeds is also denoted—that T beat Q by 32 oz. The stability of T equalled 16 oz., and that of Q 23 oz.

Therefore, Q has more stability than T, by nearly one-half, being 7 oz., which, if put in ounces, equals 30$\frac{1}{2}$ oz. But the extra speed of T was 32 oz.; and, taking 30$\frac{1}{2}$ oz., or 32—30$\frac{1}{2}$, leaves the sum of 1$\frac{1}{2}$ oz. on the side of T, which would in consequence, under equal weight and sails

proportionate to their stabilities, beat Q by the said extra weight of $1\frac{1}{2}$ oz. The models Q and T sank into the water when of the same weight, thus: Q sank $\frac{18}{16}$-inch, and T sank $1\frac{1}{18}$-inch.

The inference which may be drawn from these calculations is, that Q, if lengthened, would beat R; and R, if made longer than Q, would again beat Q. Moreover, if a model, say S, be made of the same proportional length and breadth of R, before lengthened, meaning the breadth at the midship to be two-fifths of the length, but the length of S to equal the length of R, increased, the breadth of S will then exceed the breadth of R, whose length alone had been added to, and therefore would be beaten by S.

Chapter XV.

It has been seen in the investigations of the preceding chapter, that when any two of these models were of equal weight and equal length, the one with the greatest breadth of beam beat the other. In the experiments on stability numbered 8, and scale C, it is shown when the thickness or depth of flotation is varied, the breadth and length being preserved constant, the greatest stability exists at one-fifth of the beam.

Now, it has been before mentioned in the last chapter relative to the depths of the lines of flotation, that in some instances, as in experiment 80, in I, it exceeded the one-fifth; and in others, as in experiments 81, 82, it was less. Upon testing a few of the models between one-fifth and one-fourth for the line of flotation, the following proved to be the case.

Now, with the models I and O, each having their lines of flotation situated between the one-fifth and one-fourth, which in the model I equals $\frac{3}{8}$-inch, and in O equals $1\frac{3}{8}$-inch, at this depth, the weight of I was required to be increased until it altogether equalled $39\frac{1}{2}$ oz.; and model O equalled 78 oz.

In the experiment No. 80, the models I and O, being then of equal weight, the speed of I beat the speed of O by 21 oz. Under the present circumstances, O exceeds the weight of I by 39 oz.; therefore I has the advantage over O of 21 oz. and 39 oz., or together 60 oz. With respect to the stability possessed by these two models, I and O, it was found upon trial that I in stability equalled $2\frac{1}{2}$ oz.; and O equalled $8\frac{1}{2}$ oz., showing O to have 6 oz., or two stabilities above I, which in weight equals 78 oz.; but take away the 60 oz., and there remains 18 oz. in favor of the model O, when under sail.

Likewise, in the same chapter, it is stated of the models O and Q, that when of equal weight, O beat Q by 64 oz. extra weight. Upon causing the model O to sink in the water until its load line was between one-fifth and one-fourth, it required an increase of its weight, as before given, up to 78 oz.; and Q to equal 152 oz. The stability which each now possessed, was in O $8\frac{1}{2}$ oz., and Q 32 oz.—that is to say, the model Q possesses (let it be granted) two and a-half stabilities above the model O, or in ounces $78+78+39=195$. However, from this sum must be taken the extra weight of Q above O, which is 74 oz., together with the 64 oz. the extra weight in speed, and equalling 138 oz.; or 195—138

=57 oz., which number of ounces is on the side of Q, when under sail proportionate to its stability.

Again, with regard to the models Q and R, that when of equal weight Q beat R in speed by 4 oz. extra weight. It has been mentioned before of the model Q, when the line of flotation was made one-fifth and one-fourth of the beam, that it required the whole weight to be 152 oz. The model R to be similarly circumstanced, required its whole weight to amount to 292 oz.; and the stabilities of these two models was in Q, equal to 32 oz.; and in R 42 oz.; therefore, in the present instance, R has one-third of a stability above Q, which in ounces equals 152÷3=50; but from this sum the extra weight of R above Q must be deducted. Now the weight of R equals 292 oz., and that of Q 152; then 292—152 equals 140 oz., which, with the 4 oz. representing the speed of Q above R, comes to 144 oz. The superior stability of R has been shown to be 50 oz.; therefore, 144—50=94 oz., by which Q beat R in speed.

From the above result it is clear that for the model R to beat in speed the model Q, it will be necessary to place the line of flotation considerably lower than one-fifth, so as to materially lighten the whole weight of R. But upon taking out 96 oz. from R, thus leaving 196 out of 292 oz., the stability of Q, as before, equals 32 oz.; and that of R equals 34 oz.; and R sank in the water with the reduced weight down to $1\frac{3}{8}$-inch, and Q also to $1\frac{3}{8}$-inch. The difference in the present stabilities is 2 oz. for R, which in ounces=152÷32=$4\frac{2}{3}$ for each ounce; and, therefore, the 2 oz. of greater stability=9 oz.; and being taken from 196, or 196—9=187, and 187—152=35 oz. of speed against R.

Again, after lightening the model R until it equalled in its whole weight 152 oz., the same as the model Q, the stability of R was now tried, and found to equal 32 oz., equalling that of Q; and R sank only to $1\frac{3}{8}$-inch.

It has been previously mentioned Q beat R in speed when they were of the same weight, by 4 oz.; consequently, their stabilities being now the same, Q will, under sail, again beat R. Before, however, the result was quite contrary, as R by its superior stability beat Q. This being the case, it then appears for R again to beat Q, more weight must be removed out of R; that is to say, until it is of the same precise weight as it was, as in experiment 83, namely, 81 oz. instead of 152 oz.

When the models Q and T were made to sink down into the water to the depth of between one-fourth and one-fifth of their midship breadth, the weight was required to be increased till it amounted in the total of the model Q, as before given, to=152 oz.; and that of T to=140 oz.

In consequence of the above additional weight, the stability of T equalled 18 oz.; and that of Q 32 oz.

It appears, then, from these stabilities, that the model Q has the advantage over T to the amount of three-fourths of a stability, and which, if put into ounces, equals 105, the stability and weight of T. Q exceeds T in weight by 152—140=12 oz.; but the extra speed of T over Q=32 oz., which sum must be deducted also; then Q beats T in speed, when both are under sail, by the number of 105—12—32=61 oz.

I.—Table *of the difference of the Speed between the six Models when Towed through the Water.*

[illegible]	Shape.	Beam.	Weight.	Result.
		INCHES.	OUNCES.	
I	Bird.	4	37	O beaten by 21 ounces.
O	Bird.	5¾	37	
O	Bird.	5¾	52	P beaten by 27 ounces.
P	Oblong.	5¾	52	
P	Oblong.	5¾	52	Q beaten by 20 ounces.
Q	Oblong.	8	52	
O	Bird.	5¾	52	Q beaten by 64 ounces.
Q	Oblong.	6	52	
Q	Oblong.	8	81	R beaten by 4 ounces.
R	Bird.	11	81	
Q	Oblong.	6	70	Q beaten by 32 ounces.
T	Bird.	6	70	

I is the swiftest, O the second, T the third—all of the bird shape.

II.—Table *of the difference of Speed between the six Models when considered under Sail proportional to their Stabilities, and carrying a light Load.*

Model.	Shape.	Beam.	Weight.	Depth.	Stability.	Result.
		INCHES.	OUNCES.	INCHES.	OUNCES.	
I	Bird.	4	37	0 15-16	2½	I beaten by 62 ounces.
O	Bird.	5¾	37	0 11-16	[illegible]	
O	Bird.	5¾	52	0 15-16	8½	P beaten by 11 ounces.
P	Oblong.	5¾	52	0 6-8	12	
P	Oblong.	5¾	52	0 6-8	12	P beaten by 19 ounces.
Q	Oblong.	8	52	0 5-8	21	
O	Bird.	5¾	52	0 15-16	8½	O beaten by 8 ounces.
Q	Oblong.	8	52	0 5-8	21	
Q	Oblong.	8	81	0 7-8	24	Q beaten by 12 ounces.
R	Bird.	11	81	0 13-16	29	
Q	Oblong.	8	70	0 13-16	23	Q beaten by 1½ ounces.
T	Bird.	8	70	0 7-8	16	

The model R is the swiftest under sail with the light load, T the second, and Q the third—Q being of oblong form, R and T of the bird shape.

III.—Table *of the difference of Speed between the Models when supposed to be under Sail proportionate to their Stabilities, and so Loaded as to draw between one-fourth and one-fifth of their Beams deep in the Water.*

Model.	Shape.	Beam.	Weight.	Depth.	Stability.	Result.
		INCHES.	OUNCES.	INCHES.	OUNCES.	
I	Bird.	4	39½	0 7-8	2½	I beaten by 18 ounces.
O	Bird.	5¾	[illegible]	1 3-8	8½	
O	Bird.	5¾	[illegible]	1 3-8	8½	O beaten by 57 ounces.
Q	Oblong.	8	152	1 13-16	32	
Q	Oblong.	8	152	1 13-16	32	R beaten by 94 ounces.
R	Bird.	11	292	2 1-2	42	
Q	Oblong.	8	152	1 13-16	32	R beaten by 35 ounces.
R	Bird.	11	196	1 5-8	34	
Q	Oblong.	6	152	1 13-16	32	T beaten by 61 ounces.
T	Bird.	8	[illegible]	1 13-16	18	
O	Bird.	6¾	[illegible]	1 3-8	8½	P beaten by 6 ounces.
P	Oblong.	6¾	84	1 3-8	12	

The model Q is the swiftest under sail, when full loaded, and T the second—the oblong, in this instance, being the best.

IV.—TABLE *showing the proportion of the Beam the depth of flotation ought to be for the greater Speed, with bottoms quite flat, and impelled forward by the Wind on Sails proportioned to their Stability.*

Model.	Shape.	Beam.	Weight.	Depth.	Stability.	Proportion of depth to the beam.	Proportion of breadth to the length.
		INCHES.	OUNCES.	INCHES.	OUNCES.		
O	Bird.	5¾	50	0 7-8	8½	One-seventh	5
Q	Oblong.	8	152	1 13-16	32	One-fourth.	3½
R	Bird.	11	81	0 13-16	29	One-fourt'h.	2½
T	Bird.	8	70	0 7-8	16	One-ninth.	3½
I	Bird.	4	20	0 9-16	2½	One-seventh	7

Upon a review of these tables, it will be seen that a maximum of weight and speed is incident to some form of the models, and not to others. This circumstance is most apparent in the long bird or fish shapes, since their stabilities cease to increase with additional weight, after it amounts to a certain quantity; that quantity, therefore, may be denominated the limit or maximum. But with the oblong model Q, and the duck shape model R, any increase of their weight is attended with an increase of their stability also. However, it is seen of the model Q, that with the increased stability, consequent on the additional weight, the speed is not so retarded by it as the model R, and the other models; therefore, advantage can be taken of this peculiarity for all ships intended for burthen.

(To be Continued.)

---

*Casting in Bronze.**

On Saturday last we spent some hours at the foundry of Mr. Robinson, in Pimlico, for the purpose of being witnesses to the new process of casting in bronze, by which works of great size and importance are moulded entire, instead of piecemeal as of old. Every multiplication of the acts by which a work of Art is to be transferred from its original Art-language into another increases, it will be obvious, the risk of some sacrifice of the author's intentions or proportions; so that Mr. Robinson's new method, by which a single act of translation is made to suffice, is at once a simplification and a most valuable improvement. Our readers may remember that the first experiment on a large scale was made with Mr. Behnes's Peel statue for the town of Leeds,—and the success was such as to establish the process for future great works. In the present case, the subject was the fine statue, upwards of ten feet in height, which Mr. Baily has modelled for Sir Robert's native town, Bury, in Lancashire. Of old, the casting of large pieces, even when such works were divided, took place in pits dug to contain the mould,—and the legs and trunk would have received the burning stream which was to harden to immortality within them in upright posture. On the present occasion, a huge iron case, strongly bound and riveted, had been built on the surface of

* From the London Atheneum, July, 1852.

the floor, of dimensions to receive the full-length figure in a horizontal position. Close at hand glowed and roared the huge furnace in which the fusion of metals was, under the compelling power of a heat intensified into almost invisibility, for hours going on. When this process of fusion was accomplished, the mixed metal, to the weight of more than two tons, was received into an iron cauldron, and swung by machinery to the case which enshrined the mould. In the black sand that formed the roof of this case and of the mould there was one great vortex for the reception of the flaming material,—and from this, channels running in all directions to convey it horizontally to every part of the figure at once. Here, the liquid flame was skimmed; and after a few minutes of breathless pause, under the influence of strong excitement to ourselves, and of deep anxiety no doubt to those more immediately concerned—the final signal was given. The cauldron was turned over at the mouth of the vortex by the machinery from which it swung—and in thirty seconds by a stop-watch, the Bury 'Peel' was cast! The thing was like the creation of an enchantment. The workmen at once proceeded to the task of knocking away and uncovering; —and the result is, a cast of surpassing beauty—almost perfect from the mould itself—and scarcely needing the chaser's hand.

---

*The Screw and Paddles Combined.** By J. Bourne, C. E.†

I am not aware that there are any vessels in actual existence which are propelled by the conjoint action of paddles and a screw, but some years ago I proposed the establishment of vessels of this kind, under circumstances which it will require a slight digression to recite.

The Peninsular Steam Packet Company, of which the Peninsular and Oriental Steam Packet Company is a subsequent extension, was established by my father, the late Captain Bourne, who advanced more than half the capital necessary for the establishment of the company himself, while the residue was chiefly contributed by his brothers and other members of his family. The *Tagus*, *Braganza*, and other original vessels of the company were constructed under my direction, and they were generally considered to the best vessels of their time; but for many years I have ceased to have any further connexion with the company than is implied in an interest in its success, and a desire to see it prosper. For some years past, however, its original reputation has been on the decline; the original vessels had become old and slow, and some of them had been lost, while the new vessels which had been added to the company's fleet, instead of being better than the old, were in most cases worse, so that the *prestige* with which the company started was no longer maintained.

The result of this state of things was, that various proposals for establishing a rival company were entertained; and it became obvious to me that, if a rival company were established, one of two consequences would ensue—either the new company would get the mails to carry, or if the old company succeeded in retaining them, it would only be after such a

* From Treatise on the Screw Propeller, by J. Bourne.

† From the London Artizan, August, 1852.

keen competition, and on such stringent conditions, that the service would hardly repay any contractor. Under these circumstances, I communicated with my father, who was then still living, and with some of the other directors of the company, pointing out the course which it appeared to me ought to be pursued under the circumstances related; and my recommendations were to the following effect.

It was quite clear that the very general dissatisfaction which had been expressed at the want of power and speed in the company's vessels was not unfounded. Here was a line, confessedly the most important of all our lines of postal communication, on which the vessels built ten or twelve years before were still the best, the more recent vessels being, for the most part, exceedingly slow and inefficient, when compared with other successful vessels of recent construction. It was quite indispensable, therefore, in order to meet the just expectations of the public, that vessels capable of maintaining a higher rate of speed should be introduced; and as the introduction of such vessels by some party or other was inevitable, it would not be advisable to postpone the improvement until the attempts of rival parties had been so far organized, that competition could no longer be averted by any expedient of amelioration. All this was very clear; but the question at once arose, what was to be done with the existing vessels? Attempts had been made to accelerate some of them by the application of feathering wheels, but with very inadequate results; and all attempts at petty improvements appeared to me not only futile, but injudicious, as such attempts involved a considerable expense, and practically left the vessels still unequal to the exigencies of their vocation. Now, seeing that it would be impossible to sell the existing vessels without immense sacrifice, and that it would be equally impossible to retain them, unless a radical change in their efficiency could be effected; and seeing, too, that the usual means of acceleration had been tried, at a heavy expense, but without any material benefit, it occurred to me that, upon the whole, the most judicious course would be to introduce into each vessel a separate engine, which would drive a screw, working in the stern of the vessel, in aid of the paddles; and by this arrangement it was obvious that any increase of power and speed might be given to the existing vessels that the exigencies of the case required. I recommended, therefore, that one of the smaller vessels of the company, the *Madrid*, for example, should have a screw fitted at the stern, to aid the operation of the engines; and I found that a pair of screw engines, of the same power as the existing paddle engines, of 140 horse power, could be supplied for about £800; the screw engines being light and cheap, as they would be without air pumps and condensers, and would be connected immediately with the screw shaft. If the result answered the expectations formed of it, a similar arrangement could, it was obvious, be introduced into the larger vessels without any very great expense, and those vessels would thus be enabled to maintain a rate of speed exceeding anything then existing in ocean steam navigation, and the dilemma in which the company stood of having to discard their present vessels, or lose the mail contract, would be dissolved.

This suggestion has met with the same reception and the same fate as that which I had previously made for the better ventilation of the vessels.

At first it was looked upon in the light of a great deliverance; but it has since been suffered to languish and die out, my father's advanced age, and subsequent illness and death, having prevented him from taking those active steps for its furtherance which otherwise he would have felt called on to pursue. The mechanical part of the question was referred to Mr. Penn for his opinion, whose views completely coincided with my own, the only difference being, that he stated them with greater clearness and force than I should have been able to do. Other leading engineers to whom the proposed arrangement has since been mentioned concur in the conclusions at which I had arrived. As every one of ordinary engineering attainments will be able to form a judgment for himself upon this subject, I shall here recount the nature of the intended arrangements, and the extent of the benefit which, according to my estimate, would have been obtained.

I have already mentioned, that if the power of any given vessel be doubled, her speed will be increased nearly in the proportion of the cube root of 1 to the cube root of 2. A vessel, therefore, which maintains a speed of 10 knots with any given power, will maintain a speed of about 12½ knots with twice the power; and I proposed that the power of all the Company's vessels running on important lines should be doubled wherever the usual speed did not exceed 10 knots an hour. Now this duplicature of the power I proposed to accomplish without touching the existing engines at all, and, as I have already mentioned, I proposed to apply a screw in the stern of the vessel, which was to be driven by separate direct acting engines of its own. The screw engines would not have had either air pumps or condensers; but the steam from the boilers was to enter the screw engines first, and after having given motion to them, would have passed into the paddle engines, where it would have been condensed in the usual manner. By this arrangement, the steam would have been used twice over, and twice the amount of engine power would have been exerted in the hour, without any increase in the consumption of coal. To enable these arrangements to be carried into effect, it would be necessary to work with a higher pressure of steam than has heretofore been employed in these vessels; and I proposed to use a pressure of about 25 lbs. on the square inch, which was about three times the pressure then employed. To enable this pressure to be used with perfect safety, I proposed that the boilers should be circular—such as Mr. Penn has since put into the *Hydra*, which may be worked up to 30 or 40 lbs. on the square inch, if required. It would, of course, be impossible to put any such pressure as I proposed to use upon the existing paddle engines, as it would have broken them down; but the steam was to act, in the first instance, upon the pistons of the screw engines, after having given motion to which, it would pass into the paddle engines, and be there condensed in the usual manner. There is, therefore, only the same quantity of steam to be generated under the new arrangement as under the old, and it would be generated, of course, with the same quantity of coal: but after having been employed in the cylinders of the screw engines, and been there expanded down to that point of elasticity with which the paddle engines at present work, it was to be conducted into the paddle engines, and to work them in the same way as if steam of that elasticity had come direct from

the boiler. The proposed arrangement, therefore, is analogous to that of a Woolf's engine; but as the engines employed to drive the screw would work at a high velocity, they would be smaller than the high pressure cylinders of a Woolf's engine, in the proportion of their increased speed.

It will be obvious, from the exposition I have given in the foregoing pages of the mode of action of the screw in the water, that a screw acting in aid of paddles would work far more efficiently than if it were employed alone to propel a vessel; for, as the vessel is at all times moving through the water from the action of the paddles, the screw will always have a column of water of a considerable length to act upon at each revolution, and the slip will be diminished in consequence. And as, by the operation of the paddles, the action of the screw is amended, so will the action of paddles be amended by the action of the screw. For, since the vessel will pass faster the water when an auxiliary screw is added, the paddles will gear into a greater length of water in a given time, which, as it will possess more inertia without any more pressure being employed to move it, will be operative, to a corresponding extent, in reducing the slip of the wheel. In fact, both propellers will act constantly under the same favorable circumstances as if the vessel were always sailing with a fair wind; for the screw is virtually a fair wind to the paddles, and the paddles are a fair wind for the screw.

It will be further obvious, that by adding to a paddle vessel screw engines of the same power as the paddle engines, the total power of the vessel will be somewhat more than doubled; for, when the speed is increased from 10 to 12½ knots, the speed of the paddle engines will be increased also, so that they will give out a fourth more power than before; and the increased speed of vessel due to this small increase of power will, in its turn, somewhat increase the speed and power of the screw engines. But this increase of the power I have not thought it necessary to reckon, seeing that it would only be obtained with an increased consumption of fuel, and that the speed of the vessel will not increase quite so rapidly as the cube root of the augmented power. Now, if the speed of the vessel be increased one-fourth, and the consumption of fuel, per hour, only remains the same, it is clear that the vessel will require one-fourth less fuel for the accomplishment of a given voyage. Instead, therefore, of the vessels employed upon the Indian line having to carry about 600 tons of coal, they would only require 450 tons for the performance of the same voyage under the proposed arrangement, and the weight thus saved would fully compensate for the extra weight of the screw engines and screw.

From these considerations it appears, beyond doubt, that, by the proposed mode of acceleration, about one-fourth more speed would have been obtained with a smaller consumption of fuel, and without any increased weight in the vessel. The only topic remaining for consideration is, whether boilers using such a pressure as 25 or 30 lbs. would be quite safe in steam vessels, seeing that the boilers of steam vessels sometimes get incrusted with salt, when, possibly, the furnaces may get red hot. Now, it is quite clear that any boiler which is suffered to get red hot, from whatever cause, will be productive of danger; but such an occurrence is a very rare one; and I consider that the risk of salting may be obviated by an expedient mentioned to me by Mr. Penn, as a suggestion of

Mr. Spiller's, and which appears to me to afford a perfect security against the danger. This expedient consists in the application of a feed pump, which is purposely made too large to supply the quantity of water requisite for the generation of the steam, and which is not provided with any means of shutting off the water, or allowing the surplus to escape. It will follow, consequently, that a good deal more water will be sent into the boiler than what can be raised into steam, and the surplus must be blown out by the engineer; or a self-acting float may be applied to the boiler, to permit its escape when the level of the water rises above a given point. With this simple provision it will be impossible that the flues of the boiler can ever become incrusted to an inconvenient extent, whether the boiler is leaky or not; and any objection based upon the supposition of such a possibility must of course disappear when the possibility itself no longer exists. The question, however, is not so much whether boilers with a pressure of 25 or 30 lbs. may be made as safe as boilers of a much lower pressure, but whether they may be made as safe as boilers with nearly the same internal pressure, but which are by no means adapted to sustain it. In modern sea-going steam vessels, 20 lbs. on the square inch is a frequent pressure; and in a few instances the pressure is as high as 25 lbs. These boilers, nevertheless, have flat sides, and depend for their strength upon stays, which after some time corrode, and may even be eaten through, leaving the boiler in a very unsafe state. The pressure, indeed, is always reduced in these vessels, as the boiler gets into a state of dilapidation; but such an adjustment rests the responsibility of the safety of the boiler upon the engineer, and is a practice likely to lead to accidents. Instead, therefore, of loading the boiler at the first to its maximum strength, and gradually reducing the pressure as it gets into disrepair, it appears to me to be by much the safest course to make the boiler of such a construction, at the outset, as to enable it, without the aid of stays, to withstand a very much higher pressure than is put upon it; and it will then continue to be safe even when old and worn. This, accordingly, is the course which I proposed to pursue, and it still appears to me to be the most eligible that could be adopted.

These comments have extended themselves to such a length, that the remarks I have to offer respecting the comparative advantages which vessels propelled both by the screw and by paddles would offer relatively with those presented by vessels propelled by either screw or paddles alone, must be despatched very summarily. It is only in the case of vessels intended to maintain a high rate of speed, upon voyages of considerable length, that I would propose to employ both the screw and paddles; but in those cases the combination has very obvious advantages, if the comparison be made with that measure of efficiency which screw and paddle vessels have heretofore respectively attained. Paddle vessels, when deeply, are unable to exert their power with good effect; whereas, under those circumstances, the screw acts in its best manner. On the other hand, a screw vessel set to encounter a head wind wastes much of the engine power in slip; and the performance would be improved, under such circumstances, if half the power were withdrawn to work paddles, since not only would the paddles act in such a case with great efficiency, but the advance they would give to the vessel would enable the screw to

act with greater efficiency also, as it would be perpetually coming into a fresh body of water, whereby the slip would be reduced. A vessel, therefore, propelled by paddle engines of 500 horse power, and by screw engines of 500 horse power, would be more efficient, when deep, than the same vessel propelled by engines of 1000 horse power driving paddles; and more efficient, when set to encounter head winds, than the same vessel propelled by engines of 1000 horse power driving a screw. In fact, by the proposed combination, a higher average measure of efficiency would be attained, and in so far as the screw engines would be lighter and more compact than paddle engines of the same power, a further benefit to that extent would be obtained also. The paddles, moreover, would not require to be of such inconvenient dimensions as if the whole power had to be transmitted through them, and yet a very effective hold of the water would be obtained. Should either the paddles or the screw be deranged by any accident and be unable to work, the vessel would still be able to proceed by the remaining instrument of propulsion, at a diminished rate of speed. Upon the whole, therefore, I am of opinion that vessels constructed on this plan will be better than if propelled solely by paddles, and they will be better also than vessels propelled solely by the screw, if the mode of applying the screw be the same as that which has been heretofore in use; but they will not be better than vessels propelled solely by the screw, if the screw be applied in the manner I have recommended, so as to enable screw vessels to proceed in an efficient manner against a head wind. It is mainly, however, as a means of accelerating the speed of existing paddle vessels that the plan is to be recommended, and I do not know of any mode by which an effectual measure of acceleration can be ensured with so small a disturbance of the existing mechanism, and at so small an expense. In reflecting upon the various means of accelerating vessels, when I first entered upon the consideration of this subject, other modes, as may be supposed, suggested themselves of accomplishing the same object. One of these modes was the use of feathering wheels, and the reduction of the diameter of the wheels, so that a higher velocity of the engine would be obtained. But this expedient, it was obvious, would only fall into the category of petty ameliorations, since it would be impossible to reduce the diameter of the wheel very much in vessels of a varying immersion without introducing other evils; and it did not appear advisable, moreover, to increase the speed of the engines very much beyond that at which they then worked, as many of the arrangements were not suited to a high velocity. Another idea was to interpose gearing between the engine and paddles; but this expedient had much the same objections as the preceding; and if either of these plans could have been carried into effect, it would have been necessary to increase the area of the floats in the proportion of the increase of power, else the slip would have been augmented. In both of these plans, moreover, the consumption of fuel would have risen in the same proportion in which the power was increased; whereas, by the application of an auxiliary screw in the manner I contemplated, the increase of the power would not have occasioned any increase in the consumption of fuel per mile, but would have been less than before. In all cases, therefore, in which it is desirable to increase largely the speed of

a paddle vessel, that object will, in my judgment, be best attained by the introduction of an auxiliary screw worked by direct acting engines, which receive steam of a considerable pressure from boilers of appropriate construction, and transmit the steam in an expanded state to the paddle engines, to be there condensed in the usual manner.

Explosions in Coal Mines.—Report from the Select Committee of the House of Commons, appointed to inquire into the Causes of the frequency of Explosions in Coal Mines. (*Ordered, by the House of Commons, to be printed June 22d,* 1852.)*†

The Committee, considering the pressing emergency of the matter committed to their charge, how deeply the interests of humanity were involved, (the deaths from explosions having latterly increased to the fearful number of about 1000 per annum,) determined only to examine witnesses of the highest and most experienced character, in the hope that they might be able to derive sound information, on which to recommend additional means for the prevention of such wide-spread calamities during the present session. The Committee are therefore of opinion—

That any system of ventilation depending on complicate machinery is unadvisable, since under any disarrangement or fracture of its parts, the ventilation is stopped or becomes less efficient.

That the two systems which alone can be considered as rival powers, are the furnace and the steam-jet.

The *furnace* system, under favorable circumstances—*i. e.*, of area of the shafts being large and deep, the air-courses sufficient, the goaves (or old workings) well insulated, and the mine not very fiery, appears to be capable, with strict attention, of producing a current of air that will afford reasonable security from explosion; but when the workings are fiery and numerous, as well as remote, and the intensity of the furnace or furnaces requires to be raised in order to increase, on any particular emergency, the amount of ventilation, then the furnace not only refuses to answer the spur and to increase ventilation, but from a natural law, (discovered by Mr. Gurney, and scientifically and practically confirmed before the Committee,) there arises a dangerous stoppage to ventilation going on throughout the mine.

The quantity of heat generated by the furnace is directly as the quantity of fuel that can be consumed in a given time. The amount of rarefaction or power of the upcast will always be directly as the temperature of the column of air passing up in a given time, which temperature will vary in proportion to the quantity. The amount of heat of the furnace is a constant quantity, which will be spread over a more or less quantity of air. The power of the upcast rising in *an arithmetical ratio;* the friction or drag of a current of air through the workings of a coal mine, offering a

* We have thought it necessary at present to give only the leading features of this Report, but shall probably return to the subject when the Minutes of Evidence given before the Committee are made public.—Ed.

† From the London Civil Engineer and Architect's Journal, July, 1852.

resistance, equal to the *squares* of its velocity. Now it is manifest there will soon be a point where the resistance overtakes the power. The power being as an arithmetical ratio, while the resistance increases in a geometrical ratio, the "furnace limit" will be the point where these two powers balance each other. This limit commences in practice much earlier than would appear on calculation from these data, because there is another element to be taken into calculation that seems never to have been noticed. This element is the resistance offered to the air going through a mine by the *vena contracta.* It amounts to a serious quantity in the workings of an ordinary coal mine. This amount of extra resistance, added to the friction arising from the rate of current, adds considerably to the rate of increase of the drag. This important fact has never hitherto been noticed; nor was it referred to by any of the witnesses in the Committee of 1835, or that of the Lords in 1849.

The resistance or drag of a current of air passing through the working of a coal mine is, as stated above, as the squares of its velocity. When this resistance is so great that the proper quantity of air cannot come through the galleries of a mine to fill the exhaustion produced at the bottom of the upcast-shaft, it will come down through the shaft itself, as the easiest channel. It will come down on one side, leaving room on the other for the hot air to ascend, the stationary particles of air between the two moving currents forming an imaginary aerial plate. The plate has been called the "natural brattice."

The amount of resistance of currents of air coming through the workings, increase as the *squares* of their velocity; the power of exhaustion by the upcast-shaft is *directly* as its temperature. If the quantity of air passing through a mine be reduced by increased friction or obstruction, that smaller quantity of air will be raised to a higher temperature by the furnace in the up-shaft, and the exhaustion arising from its increased temperature will produce a greater amount of *force.* The water gauge is a measure of this force of exhaustion or power of the furnace. Under the above circumstances, the water gauge will rise and indicate a *greater power*, while the *amount* of ventilation is reduced. This is a seeming fallacy: it is not a fallacy; therefore, is called the "furnace paradox."

To the powers of the *steam jet*, on the other hand, there appears to be no practical limit; for although it acts, when placed (where recommended) at the bottom of the upcast, as a rarefier to the extent of the steam used, and fire under the boiler, its principal or direct efficiency depends upon its power of propulsion. The heated air not only rises from rarefaction, but any amount of cold air can be bodily pushed up the upcast, the amount merely depending on the number and size of jets employed, and the pressure of steam. The Committee are unanimously of opinion that the steam jet is the most powerful, and at the same time, least expensive method for the ventilation of mines.

Previous to 1848, when Mr. Forster introduced the steam jet into the Seaton Delaval mine, the fire-damp was constantly seen playing around the face and edges of the goaves and other parts of the workings; since that period the mine is swept so clean that it is never observed, and all danger of explosion seems removed in a very fiery mine. The increase of ventilation is from 53,000 cubic feet per minute under the furnace

system to 84,000 under the steam jet; and to double that quantity, which Mr. Forster considers sufficient, would, he says, only require the application of some extra jets. Mr. Forster states the original outlay for the steam jet to be less than for the furnace by £39 15*s.* 6*d.*; and the annual cost to be less by £50 12*s.* 1*d.*; while the power of ventilation is increased to nearly double.

Notwithstanding the increase of ventilation which Mr. N. Wood states he has obtained in one of his collieries, where the areas of the shafts are very large, and by the aid of three furnaces, it appeared in evidence that the explosion at the Killingworth Colliery last autumn, under Mr. N. Wood's management, took place under the furnace system of ventilation.

Although a few of the witnesses (two of the most intelligent of the government inspectors among the number,) seemed to have misunderstood the mode in which the steam jet operated as a ventilator, and professed themselves so far unacquainted with it as to be unable to form an accurate judgment on its merits, all the witnesses, with scarce an exception, coincided in the opinion that in a fiery mine, even where the furnace system was thought sufficient under ordinary circumstances, it would be a prudent and almost necessary precaution to have a steam jet apparatus at the top of the downcast connected with the boiler of the engine which worked the mine, in case a sudden and great increase of power was required, under pressing emergency.

It was stated in evidence that 70 per cent. of the deaths from explosions were occasioned not by the explosion of fire-damp, but by the "after-damp" which succeeds it. If the latter be inhaled in its pure state by the miner, it causes immediate death. But since, from the miners being subsequently discovered in various stages of prostation, it is apparently inhaled in various degrees of dilution, it seems clear that a power like the steam jet placed at the top of the downcast, out of reach (which the furnace at the bottom of the upcast occasionally is not) of the effects of the explosion, and capable of sweeping the galleries of the mine with an almost irresistible force immediately after the explosion, might be the means of saving a large proportion of the lives now lost for want of such a power. The furnace under such pressing emergency is inapplicable, and incapable of being used for the purpose.

The Committee, however, are unanimously of opinion, that the primary object should be to prevent the explosions themselves; and that if human means (as far as known) can avail to prevent them, it is by the steam jet system as applied by Mr. Forster; although even in such case it might be prudent in a mine especially fiery to add an inexpensive steam jet apparatus at the top of the downcast, as a means in reserve in case of explosion from neglect or otherwise.

The proper condition of a mine, as regards its ventilation, the Committee consider is when the current of air through all the air courses, more particularly in the extreme workings, is from four to six feet per second in rate through an ordinary sized air-way, of (say) 50 feet sectional area; this, in the extreme workings, would command a rate of current to a much greater extent (and which would be necessary) through the less remote workings of the mine. Without a current of air at the rate of at

least four feet per second, equal to about three miles per hour, in *every part* of a mine at all fiery, the miner cannot be considered safe from explosion. Such current would be the truest indication of the actual amount of fresh air circulating through the general workings of the mine. It seems immaterial by what mode this rate of current is produced, so that it be certainly produced, and a means be furnished to the inspector at each visit to ascertain that such rate of current has constantly existed during his absence.

The attention of the Committee has been directed to scientific and practical means of decomposing or neutralizing the explosive gases as they exude from the coal and goaves; but it does not appear that science has discovered any practical means for producing this desirable effect. Mr. Blakemore, M. P., has offered, through the Royal College of Chemistry, a premium of £1000, for the discovery of some simple practical means for the attainment of this important object.

The Committee would now refer to some more incidental means of security against explosion; first, stating their concurrence in the opinion expressed, directly or indirectly, by the Committees of 1835 and 1849, and also with that so strongly expressed by the South Shields Committee, that where a proper degree of ventilation does not exist in a mine, the Davy-lamp, or any modification of it, must be considered rather as a lure to danger than as a perfect security. Practically secure in a still atmosphere, it may be considered; and in the hands of a cautious over-man, an admirable instrument for exploring, or as an indicator of danger; but in a current, as admitted by its illustrious inventor himself, it is not a security; and in the hands of an ordinary workman, under circumstances of excitement, when danger is threatened, it is not improbably, far oftener than imagined, the very cause of the explosion which it is intended to prevent. The experiments of Dr. Bachhoffner, at the Polytechnic Institution, before the Committee, were very interesting on this point. Nevertheless, in a mine that is at all fiery, it will be a prudent precaution to work with a lamp, until it can be proved that by means of ventilation a mine can be so far cleared of all explosive gases as to prevent any accumulation of them in the workings, goaves, or elsewhere. Some of the witnesses point to such a possibility; and if it were for the sake of the health of the miners alone, a current of fresh air passing through the mine which could produce this effect, would render such a power one of the most valuable contributions of the age. One of the principal objections to the Davy-lamp, on the part of the workmen, has been the insufficient light which it affords. A lamp of greater reflecting power, which would at the same time admit of a double gauze protection, has been suggested. It is made of polished wire gauze, instead of black iron wire. The latter has an absorbing surface, the former has a reflecting one; the latter intercepts and obstructs more than half the light given out by the flame; the reflecting lamp reflects the light which falls on the meshes of the wire gauze, and sends the rays out on the opposite side, in a profitable direction.

In the furnace system of ventilation, the power depends on the difference of the temperature of the air going down the downcast shaft and that coming up the upcast; and when the temperature of the outer air is *high*, the power of the furnace is reduced. When the thermometer, there-

fore, exhibits a high rate of temperature, the ventilation is lessened. This may account for accidents being generally more frequent in spring and summer.

Under the ordinary pressure of the atmosphere, its weight operates in a fiery mine to keep back the escape of gas from the recesses of the mine. When the pressure is less, the explosive gases have greater power of escape. Whenever, therefore, there is a fall in the barometer, showing a diminished pressure of the atmosphere, danger is indicated, and an increased amount of ventilation required. In every mine, therefore, it should be imperative for a barometer to be kept. It should be placed near the ventilating power, properly connected with the external air, through the downcast, so as to take the pressure of the atmosphere. A "Differential Barometer" is much more sensitive than a common one, and should be used; and since it costs only a few shillings, there would be no excuse for not having one. The differential barometer, so called, is more delicate in its movement than an ordinary barometer; it may be made almost to any ratio of delicacy. It would show a change taking place in the weight of the atmosphere long before it could be seen in the ordinary barometer, and therefore be highly valuable in a coal pit. On the fall of the barometer, fire-damp issues out of the goaves and recesses of the coal in larger quantities than usual, so that ventilation requires to be increased under such circumstances, and the fall in the barometer points it out before it can be otherwise seen. The barometer is said to be more useful in a coal pit than in a ship. It indicates impending storms, or change of weather, and the more delicate it is the better. The index of the differential barometer can be made to range from 50 to 100 times through a greater space than the ordinary mercurial level; and therefore slight changes in the weight of the atmosphere can be read off by this instrument, which are invisible or inappreciable in the common barometer.

A water gauge should be placed at the bottom of the upcast, to indicate the power of the drag of the mine, where the furnace is used, so as to indicate the proximation of the furnace limit. The water gauge is a tube of glass bent in the form of the letter U, one end of which communicates with the upcast and the other with the downcast shafts by a pipe; it contains a little water at the bottom of the bend, and is an indicator of the *amount of power;* its extent of break of level in the two legs is a measure of the actual *force* which is necessary to overcome the "drag of a mine." When this force is known, its rise or fall indicates whether proper ventilation is going on in the extreme workings or not; thus if the air comes through the workings by a shorter passage than it ought to do, the water gauge will immediately fall. In a late explosion, occasioned by leaving a door open between the downcast and upcast shafts, the water gauge would have pointed it out. If the water gauge rises above its working point, it shows obstruction existing somewhere in the workings. If it stands at its working point, it shows that ventilation is going right. It is a most useful instrument; it is a measure of the actual power required for ventilation, and in the possession of a practical man, will tell him where and how ventilation is going on by simple

inspection. In connexion with the anemometer, this gauge is most valuable.

But an instrument of even greater importance than the above, especially in reference to the periodical visits of inspectors, is a self-registering anemometer, by which the inspector would know at each visit the rate at which the current of air had been passing through the mine in his absence. The best instrument of this kind at present known, perhaps, is that of Mr. Biram. Three, at least, of these should be kept in every mine; one at the intake (bottom of downcast shaft), one at the return (bottom of upcast), and, especially, one or more in the extreme workings. By the anemometer the *actual quantity* of air passing may be known; and at the same time, by the water gauge, the *absolute force or power* required to move or pass that quantity may be known; so that by these two instruments the amount, power, and probable state of ventilation may be ascertained.

The goaves (old workings) in extensive mines are a principal source of danger. It has been suggested, if the water would permit, that the goaves might be as it were drained of the explosive gas by a bore-hole from the surface, acted on by a steam jet; that gas, being lighter than common air, would thus be drawn through the bore to the outer air.

For a similar purpose, a system of gas drifts along the *rise* of the coal deposit, intersecting its cleanages, banks, and interstices, and taken to the upcast shaft, might be, and in some cases has proved to be, a practical and scientific means for removing the light carburetted hydrogen gas from the coal, without permitting it to descend into the workings.

It was suggested by Mr. Gurney, also, that refuge stalls might be established at small expense, in places familiar to the miners, throughout the workings, to which, upon an explosion, they could at once fly from the fatal effects of the after-damp. At the ingoing end of the ordinary stalls, bays, or cul-de-sac recesses of the workings in a coal pit, boarding must be placed, so as to insulate it from the main air-courses, sufficiently strong to withstand the force of a moderate explosion at the spot; or of a violent one at a distance. In this stopping two openings are cut, one at the highest level, and the other as low as possible, so as to effect self-acting ventilation; by which means the bay will always be filled with good air. They also relieve the stopping from the force of explosion. On the inside two valves are suspended, so as to be always ready, in case of need, to close the openings from within. The upper opening is small, about four to six inches diameter; the under opening is sufficiently large for a man to pass through. In case of explosion, instead of the men running, as they now do, into the main air-courses, and consequently into the after-damp, they may go into these refuge stalls, close the openings, and remain there till the after-damp is removed. Taking into consideration the quantity of air required to support life for a given time, and the ordinary size of the stalls, it is clear that men may remain in them in safety for 24 hours, or longer, when properly constructed. During this period the after-damp ought to be withdrawn from the workings. These stalls are inexpensive, require no attendance, and may be made and left, or removed, at short distances, as the ordinary workings of a coal mine proceed. They should be within a hundred yards of each other, so that

one may be always at hand. A few pitmen only would be there, and have occasion to go into the same refuge. The well known laws of pneumatic disturbances show that, properly constructed, it would practically be sufficient to insulate and preserve the atmosphere of the refuge from danger of interchange with the after-damp for a long time together. In the midst, or *close to*, a violent explosion, the stoppings might be blown down; but not at a short distance. A violent explosion would produce death, by its force, in its immediate neighborhood; but in such case the refuge stalls would under any circumstance be useless. They are intended only as a protection against loss of life from *after-damp*. It has been proposed to place large safety flaps or valves in the stoppings, to guard against the force of explosion, but this seems unnecessary.

It has been stated in evidence, that boys are employed in mines to perform duties, the neglect of which in a single instance might be productive of great loss of life. They are employed, in particular, to attend to the opening and shutting of the doors or traps necessary to regulate the courses of air in every system of ventilation. It has further been stated, that even in the best disciplined pits, where the men are rarely, if ever, guilty of serious acts of neglect or carelessness, it has yet been found impossible to guard against similar negligence on the part of the boys; and accordingly it appears that in various instances fatal accidents have been traced to such negligence in the performance of the duties allotted to them. The Committee, therefore, are of opinion, that no responsible duties, the neglect of which would involve serious risk of life, ought in any mine to be entrusted to boys, or to any other class of inexperienced persons, but solely to persons in whose judgment and discretion full reliance can be placed.

Education is a point insisted on as a precautionary means both among the working colliers and their managers, as also that the qualification of inspectors should be rigidly tested previous to their appointment. In these views the Committee entirely concur. They not only trust to see education more rapidly spreading than heretofore among the working colliers, but schools of mines established, without certificates from which no overman, under-looker, or manager, shall be legally appointed to his office.

The qualification of inspectors for their office is a point of the first importance, and should be efficiently tested before a competent board, analogously with the tests exacted in various professions where the interests of life and health are involved. They should be acquainted generally with natural philosophy (especially pneumatics), chemistry, mechanics, also a competent knowledge of geology and mineralogy; and should also have had practical experience of colliery working.

Almost every witness, however, bore testimony to the total inadequacy of the present system of inspection. The numbers were too small, its powers too limited. Each of the inspectors summoned before the Committee had something like 400 mines in his district, the whole of which he would be unable to go through in less than four years. Many mines they had never visited. The Committee cannot therefore hesitate to recommend that the number of inspectors should be increased. They at present amount to six. That number probably should, at least, be

doubled, and two sub-inspectors to each chief inspector be added. In a letter of Sir H. de la Beche to the Committee, it is indicated, and it appeared also in evidence, that the present salary of an inspector was too small, at least to induce a person really fitted for the office of inspector to remain in his situation.

The Committee, for their own part, feel disposed rather to trust to the appointment of an efficient and vigilant Board; to an increased number of well-qualified inspectors and sub-inspectors, who should practically have the power of enforcing such a rate of current of air through the various parts of the mine as, in their judgment, the safety of the miners required, together with the adoption in each mine of such scientific instruments as both preserved a register of the ventilation, and gave warning of danger; that these powers should extend to the inflicting penalties for the non-possession of such instruments, and non-attention to the precautions recommended, and to stoppage of the mine until the right measures were taken. Such measures, together with the better education of the miners, and the establishment of schools of mines, and the circulation among the colliers of such rules and regulations as are adopted in the pits of Mr. Forster and Mr. Darlington, the Committee consider would go far to diminish, and ultimately almost entirely to prevent, the dreadful explosions to which their attention has been called.

On the Manufacture of Malleable Iron and Railway Axles. By George Benjamin Thorneycroft, Assoc. Inst. C. E.*

Malleable iron may be divided into two distinct classes—"Red-short" and "Cold-short," the former being generally produced from the rich ores, and the latter from the poorer, or leaner ores.

The pig-iron made from the rich ores (under the cold blast process only) is not so fluid as that from the lean ores; when, however, it has been converted into malleable iron, it is tough and fibrous when cold, but is troublesome and difficult to be worked by the smiths at less than a white heat; this want of ductility has caused it to be denominated "Red-short."

The pig-iron produced from the lean ores possesses, on the contrary, more fluidity, and it is thence well adapted for small castings; but when it is manufactured into malleable iron, although in the hands of the smith it is ductile and is easily worked, even at a dark red heat, it becomes, when cold, weak and unfitted to support sudden shocks, or continued strains, and is hence called "Cold-short."

It is obvious, that to obtain qualities of iron suitable for the various purposes to which it is now applied, a judicious mixture of these two kinds must be made; but even this will not suffice, unless the pig-iron, forming the basis, be of a proper quality. It may be received as an axiom, that good malleable iron can only be made from good dark, and bright gray pig-iron, smelted from iron ore alone, or with a very small admixture of any extraneous substance. Iron made from white pig-iron alone is never ductile, although it may be cold-short, whilst it differs materially from

* From the London Civil Engineer and Architect's Journal, August, 1852.

the red-short iron, made from rich ores; in fact, it possesses no good quality either hot or cold, and may be termed "Rotten-short."

The quality of the fuel used in the smelting furnace and in the subsequent processes is very important, for the produce of the best ores may be rendered utterly worthless by the use of inferior fuel; on the other hand, iron made from rich ores, and having great strength when cold, but which cracks in working at a red heat, if smelted with very pure coal, or charcoal, retains all its strength; whilst it becomes much more ductile than if an inferior quality of fuel had been used. Hence, when a strong ductile iron is required, the best fuel must be employed in its manufacture.

The introduction of hot blast for smelting iron rendered necessary a careful investigation into the comparative use of hot and of cold blast pig-iron in the manufacture of bars; the result of this would appear to indicate that if the same quality of materials be used in both cases, equally good bar iron will be produced; but it is more difficult to convert the hot blast pig-iron into "number one" bars, and the waste is greater, than when cold blast iron is used.

It is certain, that whilst good gray pig-iron can only be produced, by cold blast from the best materials, iron of apparently excellent quality can be produced, by hot blast, from the most sulphurous ore and fuel; indeed, to this alone must be attributed the bad reputation of hot blast iron for certain purposes. Castings for the forge and mill, such as rolls, housings, hammers, anvils, &c., which require great strength, as being subjected to considerable strain, or to sudden concussion, should not be made of hot blast iron. Wherever strength and durability are required, a mixture of qualities of iron is essential, in order to produce metal having a bright gray fracture, slightly mottled, which is the best quality. Any nearer approach to gray renders the casting weaker, as the more highly carbonized cast iron becomes (whether hot blast or cold blast), the softer and weaker it becomes, and it can only have strength imparted to it by a due admixture in re-melting. The mixture is generally the result of the experience of the workmen, as no definite system has been laid down, nor have a sufficient number of experiments been made to establish any certainty on the subject.

The same kind of distinction takes place in the texture as in the character of malleable iron—that is, the red-short quality is most inclined to possess a fibrous texture, and the cold-short to present a crystalline or granular fracture, though these characteristics can be materially modified or altogether changed, by judicious mixture and by re-working, and even fibrous iron can be made very ductile; this quality, however, will become granular, when a number of bars, all of the best quality, are bound together, and subjected, in the process of faggotting, to a sufficient degree of heat to weld them into a homogeneous mass; but if that mass be worked down again with a moderate heat into bars of the same size as those from which it was originally made, the fibrous texture will have been recovered. Such iron, whilst in the granular state, will bear impact better than if it had been made of bars whose texture was originally granular.

Malleable iron becomes granular from two causes: first, in consequence of being made from naturally cold-short pig-iron; and secondly, from a

peculiar manipulation during the process of "puddling." If the iron be made up into balls as soon as the granulated particles will stick together, or as the workmen term it "put together young, before it has got into nature," the texture will be fine, and close grained, and the fracture will present a bright granular appearance; such iron will not, however, bear sudden impact, nor will it become fibrous in texture by working until it is reduced into very small bars, or into plate-iron. All granular iron is much harder when cold, and will endure longer than fibrous iron, although it is not so well adapted for general purposes.

It is easy to give a fibrous fracture to iron, by welding the "pile" or "faggot" at a low heat, so that the interior does not become thoroughly solid; but if a pile be subjected to a sufficient degree of heat to make it perfectly sound, and the iron presents a fibrous fracture throughout, when reduced to 1½ inch square or round bars, the quality must be very good.

It has often been asserted that the peculiar quality of some of the Yorkshire iron ores caused the fine granular texture by which the malleable iron of that country is distinguished; the author has, however, uniformly dissented from this opinion, and in order to test the fact, some pig-iron was converted into bars in Yorkshire, and a portion of the same metal was sent to the Shrubbery Ironworks, Wolverhampton, where it was worked up into bars of the same size; the result of this experiment completely verified the author's opinion, as bars of the finest granular fracture and of the strongest fibrous texture, were produced from the same quality of Yorkshire pig-iron.

Identical results were obtained from Staffordshire pig-iron when subjected to different kinds of manipulation.

Swedish iron often presents, in the same bar, both a fibrous and granular appearance. This arises from the method of manufacture, which is very simple: One end of a long pig of iron is placed in a charcoal refinery, and as much metal is melted off as will make a bloom; but the workman commences working it as soon as it begins to melt, and continues to do so until the quantity required for the bloom is melted off into the fire; and when the mass will adhere together, the bloom is brought out and hammered into a bar. It must be evident that by such a process the first portion will have been subjected to a much greater amount of manipulation than the latter, and thus two qualities of iron, or degrees of malleability, are produced in the same bar.

Independently of the alterations of texture which arise from peculiarities in the process of manufacturing iron, great changes are induced by certain actions upon it when cold. Compression, or impact upon the end of a bar of iron, will alter its texture from a fibrous to a granular character. This is well exemplified by two tools used by forgemen. The first is the "gag," which is a short bar of iron, of about 2 inches diameter, employed for holding up the end of the large helve during the intervals of working; it is subjected to impact endways whenever the lower end is placed on the anvil, and the other receives a vertical blow from the helve falling about an inch upon it. However fibrous may be the quality of iron used for making the "gag," it soon becomes brittle, and literally falls to pieces as if it were made of cast iron.

The second instance is that of the tool employed in puddling, one end

of which is constantly subject to blows from a small hammer, in order to detach the metal which adheres to the other extremity; after being some time in use, it frequently breaks at a slight blow, exhibiting a perfectly granular fracture.

If a bar of fibrous iron be bent down at a short angle, the fibres of one side are compressed, and those of the other side elongated; and after being bent back again, the fracture on the compressed side will exhibit a granular appearance, having evidently lost the fibre and been broken off short.

A bar of iron reduced in the centre and used as the connecting rod of a steam engine, by being subjected to constant vibration, or bending, will soon break at the middle, and the fracture will be perfectly granular, although it may have been originally made of the best quality of iron. The connecting rod for working the large shears in rolling mills, and the rods of deep pumps, when they are so small as to bend or vibrate at each stroke, are further examples of this action.

Iron shafting in mills working horizontally being generally too strong to bend, or to vibrate, apparently retains its fibrous quality, even when twisted asunder by a sudden action; but if it be so deficient in strength as to bend and vibrate whilst at work, it soon loses its fibrous nature and is destroyed.

Railway axles should be made parallel from journal to journal, and of sufficient strength to prevent any vibration in rotating. If this general rule were adopted, there would not be any change in texture, and consequently, a less number of fractures would occur. If it be considered necessary to reduce the substance of the middle of an axle, it would be safer to use good granular iron at first, as it is naturally much stiffer and less liable to bend and vibrate than fibrous iron, and would probably not change its form so soon, or receive injury whilst working under ordinary circumstances. It is, however, the author's opinion that axles should be perfectly rigid, so as not to bend or vibrate, even if that should have to be accomplished by making them somewhat larger in the centre, like the connecting rod of an engine.

Many other causes of change could be adduced, but enough has been stated to prove that the compression of iron, when cold, is certain to change fibrous into granular iron, and that vibration or bending, even to a slight extent, if continued for any length of time, has the effect of compressing all the particles consecutively.

A series of experiments was carefully made for the purpose of ascertaining, practically, the best form for railway axles, so as to obtain the greatest strength with a given weight of material. From these experiments it would appear that the forms generally adopted are very erroneous, especially in reducing the substance of the middle of the axles, and in turning rectangular shoulders near to the journals; and they proved, that by simply moving the face of the wheel back from the neck of the journal, the strength to resist impact was increased in the ratio of 100 to 30; that the relative strengths to resist impact where there is no shoulder, and where there is one, is in the ratio of 155 to 55; that the strength of a parallel axle compared with one which has been reduced in the middle, is in the proportion of 5 inches to 1½ inch. Again, it is well known that

the strength of round bars to resist transverse strain is as the cubes of their diameters, which would give the parallel axle an advantage over the reduced axle in the proportion of 83·74 to 58·18; and as the same law obtains in reference to torsion, if the velocity is the same, the strength to resist torsion will be in a like proportion.

Mr. Thorneycroft said, that though many discussions had taken place, at different times, on the subject of the crystallization or granulation of axle bars, no decision had yet been arrived at on the subject. He was prepared to concur with Mr. Stephenson in the opinion that if the iron was fibrous when worked into an axle, no subsequent jarring motion would alter its character. The granulation of iron might arise from various causes, but nothing so surely affected it as when a bar of iron was gradually bent, so that the fibres on the inner side would be compressed, whilst those on the outer side were extended; and as this process was continued, so the granulation progressed. He did not think that nicking the iron would materially influence the appearance of its fracture, nor would a blow, which merely caused a jar, destroy the fibrous character of the iron. This was well exemplified by two pieces of iron exhibited, which had been used as liners for a tilt hammer. That portion of each which had been compressed by blows, was granular in its fracture, whilst that which had been subjected to constant vibration remained very fibrous.

With regard to the forms of railway axles, it appeared to him, from the experiments, that the nave of the wheel should not be placed close to, but at some little distance (say $\frac{3}{4}$ inch) from the neck of the journal; also, that the shoulder behind the wheel should be entirely done away with; and instead of reducing the diameter of the axle in the middle, it would be advisable rather to increase its bulk at that point, like the connecting rod of an engine. He had never heard of a single case in which the texture of a fractured parallel axle had been changed from a fibrous to a granular character, although a certain amount of granulation had been repeatedly observed with axles which had been reduced in the middle, and had then been broken in course of regular working. It appeared in all such cases as if there had been a progressive and alternate action of compression and extension of the outer fibres, from the bending of the axle whilst it was rotating; and that thus the granular fracture had been produced.

Discussion.—Mr. Gibson said he did not consider it a fair test of the strength and utility of an axle to subject it to hammering, but that it would be preferable to deduce results only from practice. He had found that those axles which were parallel throughout did not bend in the centre, but at a distance of from 7 inches to 24 inches from the nave of the wheel; whereas, axles which were reduced in diameter in the middle, almost invariably bent in the centre. He thought the shoulder behind the wheel was advantageous when of a curved form, but not when it was square to the body of the axle. The shoulder merely served as a gauge for keying the wheels accurately on to the axle.

Mr. Beattie thought the quality of the iron used in the manufacture of railway axles was so important, that he had always advocated the use of the very best material; and to that precaution might in a great measure be attributed the comparative freedom from broken axles on the South Western Railway. With regard to the form of axles, he preferred those

without shoulders, and which were uniform in section between the wheels, because any vibration produced by sudden or violent blows, from the flanch of the wheels coming in contact with the rails, or passing through points, or crossings, would then be more equally distributed: whereas, if the axle was diminished in the centre, the vibration and strain would terminate there, so that the texture and cohesive quality of the iron would, in time, be completely destroyed. It was certainly very disadvantageous to place the nave of the wheel close to the neck of the journal, and shoulders were injurious both to the strength and durability of the axle, and in fact were, in many instances, the cause of their breaking; if, however, it was thought desirable to have shoulders, as gauges for keying the wheels up, they should certainly never exceed $\frac{1}{16}$-inch in projection.

Mr. Joseph Freeman said, as a proof of the importance of the best material and of good workmanship being united in the manufacture of railway axles, he might mention that there was not an instance of an axle made by the Low Moor Iron Company having ever been broken in work; this must be attributed to these combined causes. Much had been argued as to the particular form of the axle, and so far the Low Moor Iron Company agreed with Mr. Thorneycroft that the parallel axle was the preferable form; but he must contend that good material and sound workmanship were the main points.

Mr. Thorneycroft said that the whole series of experiments he had tried, strongly confirmed his previous opinions. He had lately examined fifteen engines in iron works in Staffordshire, including ten engines in his own works, and had found in all of them that the crank pin was placed in a line with the neck of the journal, thereby receiving the strain in the weakest place, and causing constant accidents; now, if the crank pin had been made $\frac{3}{4}$-inch, or even 1 inch longer beyond the face of the crank, leaving a space between it and the spear rod, the liability of accident would have been much reduced, by the strain being thrown on a part of the pin less liable to commence fracture. If a shoulder was left on an axle, it should be curved, for if it was left square, it would induce fracture at that part. It would appear that there was a constant progressive tendency to fracture wherever opportunity was afforded for commencing. Now, a parallel axle did not afford any spot for the commencement of fracture; on the contrary, the fibres extended unbroken throughout the length of the bar; and, unless from the undue weakness of the axle, a constantly recurring bending action occurred, by which the whole external fibres were compressed *seriâtim* as the axle rotated, there could be no tendency to break it; it was therefore important not to weaken an axle by diminishing the centre of it. In conclusion, though an axle reduced in diameter in the centre, might never have been broken, yet it was much more liable to be bent than a parallel axle, and as bending could not take place without compression, which he had shown completely destroyed the fibres of the iron and subjected the parts to sudden fracture, care should be taken to avoid bending in the least degree.—*Proc. Inst. Civ. Eng., Aug.* 1852.

*On the Colors of a Jet of Steam.**

190. Professor Forbes some years ago observed, that a jet of steam absorbed the more refrangible portion of white light.† It happened during some experiments, that a blue jet of steam caught my attention, and further experiments soon assured me that it was easy to obtain a jet of almost any color.

191. A blowpipe jet was screwed on a T-piece, and the *opposite* opening of the T-piece was supplied with a stopcock, while the third opening of the T-piece communicated, by means of a tube, with the cock of the boiler. The blowpipe jet had an orifice about $\frac{8}{100}$ths of an inch diameter, and its axis was elevated about 28° above the horizon. The stopcock on the T-piece was furnished with a little contrivance, for preventing the steam that it discharged from interfering with the appearance of the steam discharged by the blowpipe jet; the use of this stopcock was to blow off the water which condensed in the steam passages. A pressure was maintained in the boiler of about 40 lbs. on the inch.

192. On fully opening the cock of the boiler, a jet of steam was obtained which appeared blue in nearly every position in which it could be viewed. Looking end on from below, the steam-jet caused that part of the heavens obscured by it to appear feebly orange-colored—the day was bright, but the sky at this quarter was overcast. On looking through the jet of steam from below upwards, but in a direction inclined about 11° to the axis of the jet—in which position a portion only of the steam-cloud could be viewed by the direct light of the clouds, the remaining portion being sheltered by the side of the window—one part of the jet appeared orange-red, namely, that part which transmitted the direct light of the clouds, while the other portion was blue. The blueness of the jet increased with the above mentioned angle until the angle was perhaps 30°, after which the blueness somewhat diminished, but was far from being extinguished at 90°.

193. By partly closing the cock of the boiler, and so discharging steam from the jet of, perhaps, not a higher presure than 10 lbs. on the inch, I could obtain a jet of steam; which, looking end on from below, was blue. It was rather difficult to obtain this blue jet, and when obtained, it kept alternating with violet. On now viewing this blue jet under an angle, as before (192) of about 20°, it appeared reddish-orange in color; this color was not visible at almost any angle, like the reflected blue (192).

194. Looking end on, and adjusting the pressure, I have occasionally seen for a moment at a time a bright green jet; also, and commonly, a blue purple. In the reflected tints I am not sure that I have seen anything more than orange-red, violet, and blue. The transmitted color appeared in my experiments more intense than the reflected tints.[3] This, perhaps, has its explanation in the fact, that when looking end on, the eye receives light which has shone through a columnar arrangement, whose length is much greater than its diameter,—while the reflected lights could only be seen by looking on the convex surface of the columnar stream of particles.

195. Prof. Forbes, after discovering the red color of a jet of steam by

* From the London, Edinburgh, and Dublin Philos. Mag., Aug., 1852.

† Philosophical Magazine, S. 3, vol. xxv. p. 121.

transmitted light, connected the red color of the clouds with this fact; and the truth of this connexion is beyond dispute. So far, however, as I have been able to go, the colors of the steam-jet are manifestly only instances of ordinary interference, greatly resembling that produced by thin transparent plates; the transmitted ray being always complimentary to the reflected. Thus in (192) the transmitted light is red, as in Prof. Forbes's experiments, but the reflected light is blue. It is therefore to be inferred, that all the colors of the clouds originate in interference, caused by minute drops of water, the size of which determines their color; while the blue jet (192) is, I think, strictly analogous to the blue sky.

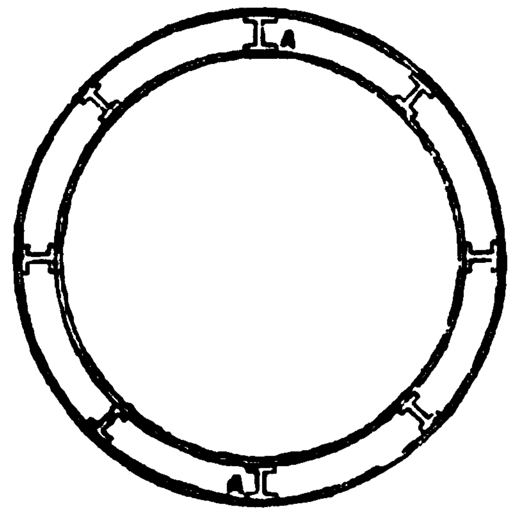
7 *Prospect Place, Ball's Pond Road, June* 28, 1852.

Note on the Construction of Sailing Vessels. By J. P. Joule, Esq., F.R.S.*

Since the now far by-gone times of Peter Pett, the great improver of naval architecture, the general form of ships' rigging has remained unchanged, or, at least, without any material alteration. In our finest vessels we have still the lower, top, and topgallant masts, supported by their respective shrouds and stays. The sails belonging to these masts have still pretty much the same contour; and although attached to the yard throughout the entire length of the head, they are only secured by the corners of the foot, or the clews, to prevent chafing with the stays.

This general form, sanctioned by the experience of centuries, is probably the best which could be employed with wood as the material for the mast; for the capabilities of wood, in resisting a crushing force, are so trifling, that it would be impossible to work a mast of it without lateral support from ropes. With iron, the case is different. The experiments which led to the execution of the Britannia and Conway tubular bridges, have safely demonstrated the great strength of hollow tubes of that metal, and have induced the adoption of the tubular system of metallic construction, in a constantly increasing variety of forms and uses. Of such applications, I am convinced that one of the most important will eventually be in the construction of masts of sufficient strength, to support themselves without the extraneous aid of the usual standing rigging.

Fig. 1.



A conical tube of wrought iron, six feet in diameter at its base, and with plates an inch thick; or, what would be still better, two concentric tubes, each of half-inch plates, and riveted together by means of intervening strips of metal, or transverse stays, would advantageously replace the mainmast and shrouds of a ship of 2000 tons. The weight would be the same, and thus, so far as "top-hamper" is concerned, no disadvantage would result. It is also obvious, that the upper parts of the mast might be constructed to slide within the lower parts, so as to secure the conveniences occasionally derived from lowering the topmasts of an ordinary

* From the London Practical Mechanic's Journal, August, 1852.

ship. The following advantages may be expected to arise from the use of the iron self-supporting mast:

1st. Its strength would be greater than that of its timber competitor, whilst it would, at the same time, be more evenly distributed.

2d. Less resistance would be opposed to the wind, in the ratio of about 2 to 3.

3d. In consequence of the absence of the stays and shrouds, the foot of each sail might be attached to the yard at several places in addition to the clews, and thus a greater effective area of canvass would be obtained, and the tendency to "balloon" would be prevented.

4th. The yards might be braced up to as small an angle with the keel line as the seamen could possibly desire, and hence the sails would be turned to the best advantage when sailing on a wind.

Fig. 1 represents a horizontal section of my proposed duplex concentric tubular mast, taken near its base, the tubes being each of half-inch iron, riveted together by the stays, A.

[Masts of tubular wrought iron have already been used to some extent, but only, so far as we are aware, for large steamers. One or two large iron ships, of Clyde build, have been so fitted, but we are not in possession of their actual details of construction, or their behaviour at sea. Telescopic bowsprits, to work on the principle proposed by Mr. Joule for striking the topmast, have also been patented by Mr. Borrie, but they have not yet come into regular use, although we know that the weight of such constructions in tubular wrought iron is only two-thirds that of the same details in pine. It is, in fact, scarcely possible to overrate the advantages derivable from such a system of construction, for, whilst greater strength is obtainable, with less dead weight, than when timber is used, the telescopic plan furnishes great facilities in the transport of vessels in harbor, as well as in easing their laboring at sea, and enabling them to carry a press of sail much longer. In bowsprits, the jib boom running inside keeps the strain directly on the centre, and obviates the severe twisting strain usually experienced at present in a sea way. Masts and spars also partake more or less of these advantages. Besides, the great losses from the natural decay of timber, and the heavy expense of replacing sprung bowsprits, lower and topsail yards, must be enormously diminished with the employment of tubular iron; and the great improvement in appearance, in comparison with the confessedly clumsy bowsprit, jib boom, and topmasts, is a point by no means to be disregarded.—Ed. P. M. Journal.]

Process for giving Various Objects a Pearly Lustre. By O. Reinsch.*

To produce the iridescence of mother-of-pearl on stone, glass, metal, resin, paper, silk, leather, &c., Reinsch adopts the following process:—2 parts of solution of copal, 2 parts of that of sandarach, and 4 parts of solution of Damara resin (equal parts of resin and absolute alcohol), are mixed with half their volume of oil of bergamot or rosemary. This mixture is to be evaporated to the thickness of castor oil. If this varnish

*From the London Chemical Gazette, June, 1852.

be then drawn by means of a feather or brush, over the surface of some water, it will form a beautifully iridescent pellicle. This film is now to be applied to the objects which are to be rendered iridescent. The vessel in which the water is contained, on which the pellicle has been produced, must therefore be as large as, or larger than, these objects. The water should have about 5 per cent. of pure solution of lime added to it; its temperature should be kept at about 72°. The objects are dried in the air.—*Kunst und Gewerbebl. für Baiern*, 1852, p. 165.

For the Journal of the Franklin Institute.

Remarks upon Maynard's System of Priming for Fire Arms. By Wm. N. Jeffers, U. S. N.

If we examine the history of inventions, we find that at all periods the class of offensive weapons has exercised the ingenuity of men of all professions, and of this class, portable, or technically *small arms*, furnishes the greatest number. Their use and mode of fabrication being generally well understood, inventive genius has been able to produce the most varied combinations, in general intended to increase the rapidity of firing, and new efforts are being constantly made to adapt these inventions to the requirements of the military service. Hitherto, the principal difficulty has escaped the penetration of inventors; and, while repeating and revolving, breech-loading, and other arms, designed to supersede the musket, have multiplied, until nothing remains new or patentable but the improvement of the mechanical execution of some part of the machinery, the musket itself has suffered from a general neglect.

The progress of invention is generally with rapid strides, when the necessity for its exercise is made apparent, until a point is reached bordering upon absolute perfection; but if we trace back to the fifteenth century the successive improvements which have been made upon the musket, we are astonished that so little has been in reality accomplished.

The invention of cannon having preceded that of portable guns, it was not until the latter part of the 15th century, that a weapon was produced resembling the musket in having a wooden stock, and intended to be supported at the shoulder with the left hand, while fired by a match held in the right. The improvement of this weapon, by the addition of a bent lever, one end of which formed the trigger, the other end carrying a lighted match, which by a movement of the lever could be brought in contact with the priming, occupied another half century, and at this point the Chinese still rest. The next step was the invention of the wheel lock; in which, by the friction of a revolving wheel upon a composition, a shower of sparks was produced, which inflamed the priming: but it was not until 1540 that fire arms entirely superseded the bow and the sling. Sixty years later, the invention of the flint lock gave to the musket its character, and at the end of the seventeenth century, the match lock was finally abandoned.

Two centuries, and those the most prolific in inventions, have elapsed, and the flint lock is still the most common means of igniting the charge in sporting guns; and experienced officers do not hesitate to declare, that in the hands of undisciplined troops, the flint has upon the whole an advantage over the percussion system, as at present arranged. The principal, and, since the invention of the cartridge by Charles XII. of Sweden, almost the only defect in the musket which remains to be overcome, lies in the mode of igniting the charge.

The objections to the flint lock are so generally known and appreciated, that it is unnecessary to repeat them. But the simplicity of the percussion lock; the greater certainty and rapidity with which the charge is ignited; the security from dampness in fogs or rain; the diminution of the charges, and their equality, both of which are conducive to accuracy of firing; the capability of firing a greater number of rounds before cleaning the gun; and various minor but positive advantages which the system possesses over the flint lock, are not sufficient to balance the inconveniences resulting from the difficulty of placing the cap at night, with clumsy fingers, when benumbed with cold, or during the excitement of battle.

To obviate these inconveniences, unwearied efforts have been made to arrange machines for placing caps upon the cone, some attached to the gun, others used by hand, all of which having failed to perform the object, have passed into collections of sporting curiosities. Not satisfied with the cap, which had been generally adopted after long trial had proved it to be with its many disadvantages superior to all other previously known methods, inventors have lately exhumed old and invented new arrangements, until all possible arrangements of reservoirs for pills, tubes, and wafers, would appear to have been tried, and found to be totally unfit for arms in common use, whether placed by hand or the action of machinery. For sporting purposes, therefore, the evil has been suffered to exist; in the military service, one evil has been substituted for another, by enlarging the cap to such a size, weight, and strength, as to be tangible to fingers more accustomed to the mattock than the hair trigger.

This cap, even when made of pure copper, well annealed, that no bits may be blown off to the damage of face and eyes, opposes such a resistance to the blow of the hammer, that it is necessary to form the main spring of the musket of such strength as to require a weight of *eighty-five* pounds to bend it up to the cock notch. Some idea of the force of the blow can be obtained from the fact that the top of the cap is sometimes cut off, and a piece of the copper forced into the vent, which can with difficulty be cleared by digging out the copper with the point of a knife. The effect of this shock on the side of the barrel, in increasing the vibrations and twisting the musket out of the line of aim, aggravated by the difficulty of pulling the trigger, can only be appreciated by those in the habit of handling the arm. For sporting guns, caps are not always made and annealed with sufficient care; hence the necessity for the inconvenient and unsightly snail shell guard, to protect the eyes from flying fragments of copper; and the slight adhesion of the fulminate to the bottom of the cap makes necessary the well known precaution which expe-

rienced sportsmen exercise, of examining each cap before putting it on the cone, to see that the priming has not dropped out. The caps must be carried in a pouch or pocket, from which, if easy of access, the caps are spilled or lost; if securely closed, it is difficult to open, and the operation occupies a considerable time.

The objections to the cap system in the military service, and generally applicable to sporting arms, may then be briefly summed up as follows:

1. The caps are necessarily separated from the gun and the cartridge box, to be carried in a separate pouch, from which they are easily lost, and taken with difficulty.

2. After firing, the motions of half-cocking, handling and placing the cap, and letting down the hammer to secure the cap, occupy, with the best drilled troops, at least one-third of the total time required to re-load; with raw troops, a longer time is required to cap than load.

3. Placing the cap is at all times difficult; but at night, when the sense of touch is the only guide, or with benumbed fingers, it is frequently impossible.

4. A slip from half-cock, or a fall, whether the hammer is down or not, may and often does explode the cap, producing serious accidents.

5. The necessary strength of the springs of the lock seriously affects the accuracy of firing; and when we consider the cost of bringing a soldier in front of an enemy, it must be admitted that no pains ought to be spared to remove, or at least diminish, every cause which militates against the effectiveness of his fire.

If then the cap system is liable to so many and such serious objections, it may be asked, if there is no probability of the discovery of a preferable system? We answer, that such an arrangement already exists; and, were it not that the same force of prejudice and habit still exists, which retained the match lock in service for half a century after the invention of the flint lock, the *Maynard* system of priming would be universally adopted.

In the year 1844, Dr. Edward Maynard, of Washington, an élève of the Military Academy, had his attention directed to this subject. After study and experiment had perfected the idea, he published in 1845 his invention of an entirely new system of priming; in which, retaining from what was already known only the percussion principle, were combined the following leading features, which we mention in what we consider the order of their importance:—simplicity; absolute safety from accidental explosion of the magazine; complete isolation of the separate charges, and yet their union in one piece easily managed by clumsy fingers; exemption from deterioration by exposure to dampness; facility and certainty of fire; increased rapidity of fire; facility of inspection without displacing any of the parts; applicability to existing models of fire arms at a small cost, without requiring any alteration in their form; less expensive than the cap system: all of which advantages it is believed were attained by an arrangement of which the following is a description:

The detonating material of the "Maynard Primer" is in the form of little circular lozenges, each about one-fifth of an inch wide and one-thirtieth of an inch thick. These lozenges are enclosed between two

narrow strips of strong paper, cemented together, and rendered water-proof and incombustible. The strip thus formed is a little less than one-fourth of an inch wide, is very stiff and firm, and contains five of these lozenges (each of which is a *charge*,) in every inch of its length; the charges forming little projections of their own shape, on one side, having considerable and equal spaces between them; the other side of the strip being one flat and even surface.

One of these strips containing fifty or more or less charges, is coiled up and placed in a pear shaped magazine milled into the lock plate just in advance of the hammer, and is fed out by the action of a finger pivoted to the tumbler of the lock, one charge at each time the hammer is raised from half-cock to cock. When the hammer descends, it cuts off and fires the charge fed out upon the vent (or nipple if one is used) of the gun, thus igniting the powder of the cartridge in the barrel; the finger is with-drawn behind the next primer, ready to thrust it forward on re-cocking, while a stationary spring holds the coil.

"These primers are made by a machine capable of making a million per day, at about one-tenth the cost of the percussion caps in military use."

Comparing this arrangement with the existing system, the following advantages claimed by the inventor, are made apparent to the most superficial observer:

1. The soldier applies one coil of priming containing sixty charges (one half more than he has cartridges) to his musket when he has leisure, and has nothing more to do with the priming until these sixty rounds have been fired; hence, in loading, the whole manipulation of "priming" in action is dispensed with; and, according to the testimony of Brevet Major Larkin Smith, with a gain of an increased rapidity of fire of thirty per cent.

2. By the motion of the hammer from "half-cock" to "cock," the gun primes itself with a mathematical precision unattainable by hand, without regard to its position, or to heat or cold, by night or day, in fair weather or foul, whether the soldier be in haste or at ease, attentive or not, skilful or awkward.

3. The primer cannot be fired with the hammer "down" or at "half-cock," nor can it be accidentally separated from the gun, or damaged by being jolted or knocked about with the gun.

4. No jarring, such as is produced by coming to "order arms" upon a stone, or striking the hammer in getting over fences, or catching it among the limbs or twigs of trees, or the dress, or trappings of horses, or rigging of vessels, or any similar disturbance of the lock can fire the primer.

5. The priming requires no tools or appendages, and but a moment's explanation, to be perfectly understood and applied by the soldier.

6. No pieces of metal or other annoying substances are thrown off from the primer.

7. It costs about one-tenth as much as the copper caps now used in the service, occupies less than one-fourth their space, (five hundred primers may be carried in a cylinder occupying in the cartridge box, or elsewhere,

the space of one cartridge,) is of about one-twelfth their weight, and is equally proof against the effect of any climate.

Frequent and prolonged trials in the presence of boards of experienced officers have proved that these advantages exist; but in order that any proposed system, although apparently preferable, should supersede an existing one, it is not merely requisite that it be superior, it is also necessary that it possesses marked advantages, and that these advantages be demonstrated by experiments made under circumstances analogous to those in which troops are placed exposed to all the vicissitudes of service in war. In military affairs, experiment is the only safe guide, and what experiment fails to demonstrate, it is as well to deny, or at least to doubt.

This invention has been submitted to that test, and its superiority over the cap system abundantly proved. Having been for several years subjected to the most rigorous criticism by experienced officers, whose scrutiny had been invited, a hundred real and imaginary objections to the system had to be met and overcome by its author, before the musket, altered from the flint lock in the most clumsy manner to save the expense of half a dollar on each, was placed in the hands of two companies of troops serving in Texas. After some months of exposure, equal in all respects to the circumstances of an active campaign, the most favorable reports were made by the officers commanding the companies, and the report of Major Larkin Smith, one of these officers, winds up by giving as the opinion of himself and other officers who have had practical experience and observation of it for military use, "that it will supersede the cap system."

Toward the close of the Great Exhibition, this invention, which at first, from its great simplicity, and the universal belief that the musket was not susceptible of improvement, was entirely disregarded, assumed a position due to its merits, and riveted the attention of the military of Europe. The defects of the cap system had been felt and acknowledged by them, and their endeavors to obviate these defects had led to a somewhat extended adoption of the needle musket, in which the charge is ignited by friction. Nothing but the advantage of doing away with the cap could have recommended this most objectionable arm to a favorable consideration; it combines all the worst features of the breech loading system, with those peculiar to the union of friction powder with the cartridge.

The Maynard system is now being experimented upon in England, by a board of distinguished officers, the report of which cannot but corroborate that made by our own; and, should not prejudice or interest interfere, we may expect that it will speedily be adopted.

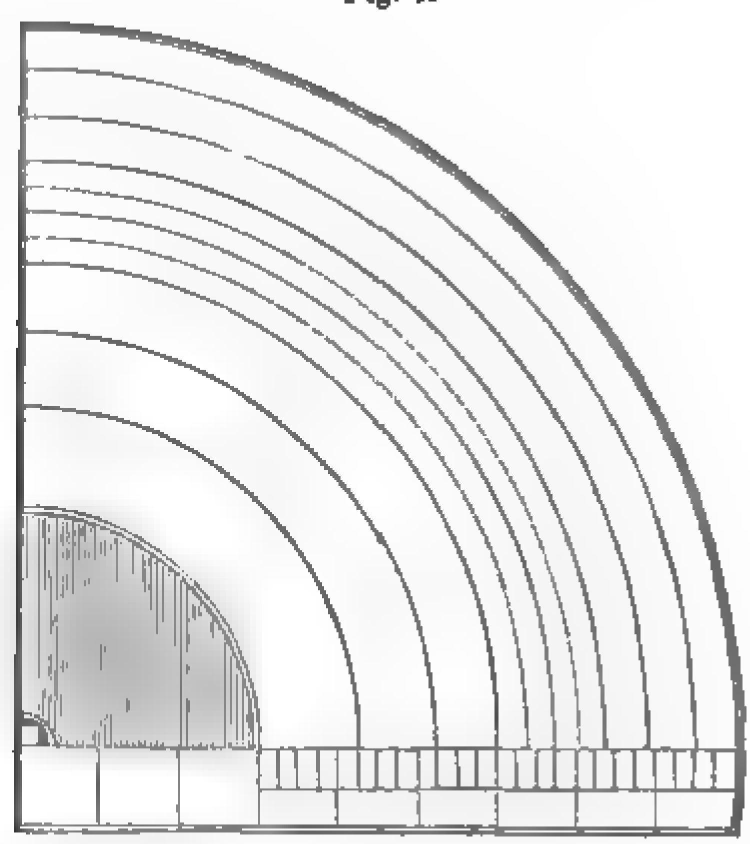
In our own service it is steadily working its way into favor; but the principal obstacle to its general adoption is the want of accurate knowledge of its construction and mode of operation; a knowledge which the writer of this notice, from a sense of its great merits, has endeavored to extend. We leave this subject, trusting that this invention may be examined without prejudice, and with the attention due to its importance; an importance which may be more readily appreciated when we state that at a saving of expense it doubles the efficiency of our arms.

For the Journal of the Franklin Institute.

The Theory of the Main Spring of a Watch; showing how to select and adjust one that will fit in every respect, without having to try it in the Barrel. By ALEXANDER YOUNG, Camden, S. C.

Figure 1 is an enlarged sketch of one-fourth part of the spring barrel of a watch. It is laid off into nine equal spaces, eight of which are to show the theory of the action of the spring. The centre space is for the arbor, and is one-third of the diameter. There is a scale of twenty-four equal parts, corresponding to the thickness of the spring, which is estimated by the proportion it bears to the diameter of the barrel: suppose it to be 72 to 1.

Fig. 1.



Two coils of the spring placed in the outside space will then fill it, and if wound on the arbor will fill the inside space, making five coils; if it is attached to the barrel and arbor, as usual, it will cause three revolutions in expanding back to its first position. Nineteen coils will fill the seven outward spaces; and if wound on the arbor, the seven inward spaces with twenty-two coils; having the same difference and revolutions as above, but with greater power, and the action will be more uniform.

Nine and one-sixth coils will fill the four outside spaces, and when wound on the arbor, the four inside spaces increased by five and two-thirds coils. The spring has most action when it fills four spaces, or half the barrel; if it extends to the middle of the fifth space, it will lose one-sixteenth; if to the whole five spaces, one-quarter of a revolution, but will gain in power, and transmit it more uniformly. A scale for any thickness of spring can be applied to the same figure.

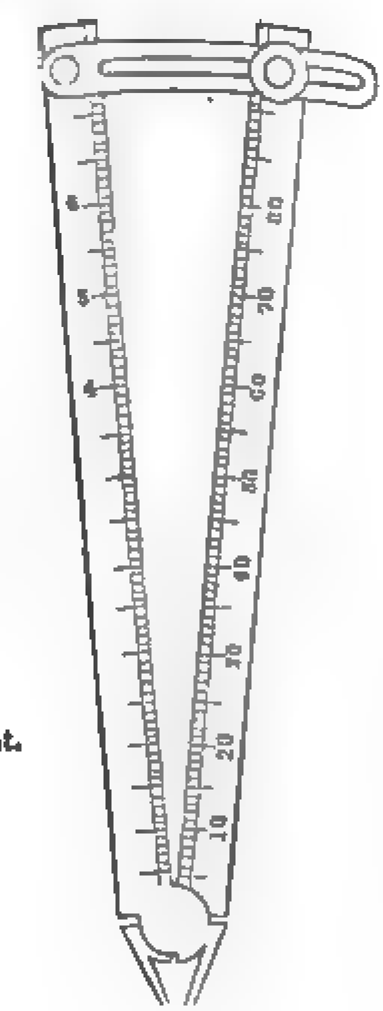
Table of the radius of the circles that divide the spring barrel into nine equal spaces; also, the revolutions taken from them, which are equal to the number of coils that the spring has when wound on the arbor over the number it has when expanded against the rim of the barrel.

The two middle spaces are subdivided; the radius of the two circles and the revolutions made by those divisions are interlined.

Radius of the Circles.	Revolutions.
36,000	
33,940	2,910
31,754	4,531
29,392	5,392
28,142	5,597
26.832	5,664
25,455	5,597
24,000	5,392
20,777	4,531
16,970	2,910
12,000	

The drawing, fig. 2, shows the form of the callipers and sector combined; the long end is four inches, and is divided from the centre of the joint on both legs, into one hundred equal parts; the divisions opposite to 60, 70, and 80, are marked 4, 5, and 6, corresponding to the numbers for the revolutions of the barrel. In the tables it has a clamp and screw limiting its opening to one inch.

Fig. 2.



The short or calliper end, is four-tenths of an inch, opening to one-tenth, or as ten to the distance across from any two corresponding numbers on each leg of the sector.

The following table shows how many revolutions of the barrel will be produced by the different thickness of the spring. A deduction is made for attachments at the ends, and for the soft part of the spring not unwinding from the arbor, and may amount to one-third of a revolution for a spring of one-eightieth, and to three-quarters, when it is one-sixtieth of the diameter.

Coils of the spring to the diameter of the barrel.	Revolutions by theory.	Revolutions by experiment.
60	4·72	4·0
62	4·88	4.2
64	5·04	4·4
66	5.19	4·6
68	5.35	4·8
70	5·51	5·0
72	5·66	5·2
74	5·82	5·4
76	5·98	5·6
78	6·14	5·8
80	6·30	6·0
82	6·46	6·2
84	6·61	6·4

To select a spring for any number of revolutions, open the sector to the radius of the barrel, at the number on the scale, for the required revolutions, the callipers will then just admit five coils of a spring when of a suitable thickness.

To find the weight of a spring for any size of barrel, take the inside diameter in hundredths of an inch, which is done by opening the sector to its limit, then apply the barrel cap to reach across from side to side, to the same numbers on the counterpart scales, which will be the diameter. The width of the spring is found in the same way. Then enter the table with the diameter of the barrel, take out the three opposite figures, and multiply by the width of the spring, which gives the weight in troy grains for a spring that will fill nine-sixteenths of the barrel.

The table is constructed by taking the area of the arbor from the area of the barrel in hundredths of an inch; nine-sixteenths of the remainder multiplied by 1900, the grains, in a cubic inch of watch spring, gives the numbers for the table.

If the arbor is less than one-third of the barrel, the callipers should fit tightly, and the spring have full weight; if larger, the callipers should fit loosely, and the spring have short weight.

Table of the diameter of the barrel in hundredths of an inch.	Weight of the spring in grains, troy, for every hundredth of an inch in width.
50	1·86
51	1·94
52	2·02
53	2·10
54	2·18
55	2·26
56	2·34
57	2·42
58	2·51
59	2·60
60	2·69
61	2·78
62	2·87
63	2·96
64	3·05
65	3·15
66	3·25
67	3·35
69	3·45
69	3·55
70	3·65
71	3·76
72	3·87
73	3·98
74	4·00
75	4·20

The next table is constructed by experiment with a spring twelve-hundredths ($\frac{12}{100}$) of an inch wide, filling five spaces, or five-ninths of a barrel, $\frac{67}{100}$ths of an inch in diameter, of which the thickness of the spring is $\frac{1}{78}$, and weighs 45 grains. The barrel having the chain lapped round it, with a scale for weights, and held fast by the arbor, when the weights are put in the chain, will unroll; the weights required for each revolution are noted, and placed in the table. The spring is then taken out, and its length reduced by breaking off $4\frac{1}{2}$ grains; when replaced, proceed as before, placing the results in the second column of the table. Then remove another $4\frac{1}{2}$ grains, leaving 36 grains of the spring. The weights applied as before, gives the numbers for the third column of the table, which shows the intensity of the spring at the end of each of the five revolutions; when it fills five, four and a half, and four spaces.

	Troy ounces sustained.	Ounces sustained; four and a half spaces filled.	Ounces sustained; four spaces filled.
	9	8	$7\frac{1}{4}$
	12	11	$10\frac{1}{4}$
	14	13	$12\frac{1}{4}$
	16	15	$14\frac{1}{4}$
	18	17	$16\frac{1}{4}$
Sum,	69	64	$60\frac{1}{4}$
No. of revolutions,	$5\frac{3}{8}$	$5\frac{3}{8}$	$5\frac{6}{8}$

The sum for each column gives the weight raised to a height equal to the circumference of the barrel. The greatest amount of power is obtained when the five spaces are filled; with four only, there will be more left over the five revolutions, but not sufficient to compensate for the loss of power.

The spring of the best watches fills four and a half spaces, and has a revolution over, to allow for straining up, and still leaving a part free.

The sector, the table, (which can be copied on a card,) and a pair of small scales, with grain weights, are all that is required to select a spring that will have the desired number of revolutions, and the greatest power the capacity of the barrel will admit.

On the Manufacture of Hydrocarbon Coal Gas from Boghead Coal. By ANDREW FYFE, Esq., M. D., F. R. S. E.*

In a paper published in the *Journal of Gas Lighting* for July, 1850,† I drew the attention of the public to the quality of resin and water gas, and then stated that the gas thus produced had not the high value that was ascribed to it by those who had introduced it, and that, consequently, its introduction as a source of light ought to be abandoned. That I was correct in my conclusions, has been proved by the process having been given up by its most strenuous supporters, and by the patentee himself. Since that time, attention has been drawn to the influence of water over coal gas, and marvellous accounts have been made public of the enormous saving that is to be effected by the introduction of what is now styled "hydrocarbon gas from coal."

In my report on Boghead cannel coal, published in November, 1850, after stating the remarkable qualities of that coal for the purpose of illumination, I concluded by observing:

"It is valuable, not only on account of the large quantity of gas which it affords, and for the high illuminating power of that gas, as indicated by the photometer—it will be found also to be extremely valuable from the large quantity of matter condensable by chlorine which it contains, and which is the principal source of light. Accordingly, were Boghead coal gas mixed with gas from inferior kinds of Parrot coal, and from English caking coal, it would add greatly to their illuminating power; or, which is the same thing, were Boghead gas *diluted* with gas from these inferior coals, while the quantity of gas would be increased, the illuminating power of the Boghead coal gas, as indicated by the photometer, would, most probably, be very little diminished. I conceive, therefore, that the Boghead coal will be of great use to those using inferior kinds of coal in the manufacture of gas, such as the poorer Scotch cannel coals, and especially the English caking coal."

At the time that I made the above remarks, I had in my mind gas, not only from *inferior kinds of coal*, but also from water, by the hydrocarbonizing process, with the view merely of *diluting* the rich Boghead gas, and of enabling us to consume it advantageously; as I conceive that, by the methods in use for burning gas, those rich in matter condensable by chlorine are not so consumed as to make them give the light that they ought to yield, were they properly burned. Since the publication of that report, I have been anxious to put these opinions to the test of experiment; circumstances, however, have prevented me from doing so till within the last few weeks. Having lately had the opportunity of thoroughly investigating

* From the London Mechanics' Magazine, July, 1852.

† Republished in *Mech. Mag.*, vol. LIII., p. 92.

the subject, I shall now enumerate the results. These trials, I may state, were undertaken solely with the view of ascertaining whether the use of water would in any way prove beneficial in the manufacture of coal gas for illuminating purposes; and as I thought that Boghead coal, from its great quantity of volatile matter, and from the high per centage of matter condensable by chlorine in its gas, would be most likely to prove the truth or fallacy of these opinions, I have confined my trials entirely to it.

In considering the hydrocarbon process, as it is now generally styled, two important questions occur:

1. Is there any increase in the *amount of light* obtained from a given weight of coal?

2. Is there any economy in using the water and cannel coal gas, instead of that from Boghead alone?

In the experiments, the results of which I am now to give, the Boghead coal that was used was that with which the gas works at Aberdeen have lately been supplied for the manufacture of their gas.

In my printed report on the value of Boghead cannel, I gave the results of my trials on that which was at that time sent to the works, as yielding 14,800 feet of gas per ton; having 27 per cent. of matter condensable by chlorine, one foot of which gave the light of 7·72 sperm candles burning 140 grains per hour—that is, 9·4 candles of 120 grains; thus making one foot give the light of 1080·8 grains of sperm; the gas per ton of coal was, consequently, equal to 2283·2 lbs. of sperm.

To secure accuracy in the trials with water, the quality of the Boghead coal to be used was first ascertained. For this purpose a quantity of it was broken to pieces, and set aside for the experiments, both on the coal alone, and for the water process. Six trials were made at different times, in the usual way, excepting that the heat was higher than in the trials formerly reported on. Seven pounds of coal were used in all the trials. The following are the results. The durability is that of a cubic foot burnt through a jet one thirty-third of an inch in diameter, and 5-inch flame. The candle is one burning 120 grains per hour.

The average of these trials gives one foot of gas, equal to 11·79 candles of 120 grains, and the gas from a ton of coal equal to 3253·5 lbs. of sperm: a much higher quantity than I got before; but it must be kept in recollection that it was this cargo of coal on which the water trials were made.

Cubic feet per ton.	Specific gravity.	Condensation by chlorine.	Durability.	Argand 58 holes consuming ft. per h.	Illuminating power 1 ft.=candles	1 ft.=grs. sperm.	Gas of 1 ton=lbs sperm.
			m. s.				
15,866	595	23·75	75 50	4·00	10·57	1260·0	2856·0
15,413	738	26·00	85 50	5·05	11·62	1399·2	3082·0
17,680	698	23·00	83 20	3·06	12·12	1454·6	3674·0
16,320	652	20·00	80 00	3·77	11·93	1431·6	3337·6
15,866	637	20·00	79 20	4·00	11·96	1435·5	3255·0
15,413	689	21·05	82 00	3·87	12·55	1506·0	3315·9
16,093	650	19·75	81 03	4·12	11·79	1414·5	3253·5

In conducting the trials with the Boghead and water together, I had

recourse to an apparatus similar to that erected by Mr. White at Grand Holm, in the neighborhood of Aberdeen, and to those used at Manchester and other places. It consisted of two iron retorts; one for the generation of water gas, the other for the coal gas. Each retort was 2 feet 6 inches long, ⌓-shaped, and 9 inches wide. In each there was a diaphragm, passing from the mouth to within 3 inches of the other extremity, dividing it into an upper and under compartment, shut off from each other, excepting at the back end. Both compartments of the water retort were filled with charcoal, and a tube from a tank conveyed water into its upper compartment, by which the water was made to pass first through the charcoal in it, and then in the lower one, from which the gas generated, along with surplus steam not decomposed, passed through the coals into the lower, and then into the upper compartment of the coal retort. From this it proceeded to the hydraulic main, the condenser, and purifier, to the gasholder, in the usual way. In all the trials two gasholders were used; these were exactly of the same dimensions, were nicely equipoised, and accurately graduated. The whole of the gas thrown off was propelled into them uniformly in the same ratio during the whole of the performance of the experiment, as was proved by their rising in the same ratio; but, to secure accuracy, the gas in each was tested, and found to be of the same composition. In manufacturing the gas, sometimes the usual heat, sometimes a higher, occasionally a lower heat, was resorted to. In ascertaining the illuminating power by the Bunsen photometer, a sperm candle, burning 140 grains per hour, was always employed, and then proportioned to one consuming 120 grains, so as to enable me to compare the results with those of other experimenters. The gas was burned by a 58-hole Winfield Argand; and different trials were made with each gas, to find out the most profitable consumpt. It is unnecessary for me to record all the trials; I leave out those made at first with the view of finding out the proper mode of proceeding, as I found that the process is a very uncertain one, the results varying very much, even when it seems to be conducted under similar circumstances.

The following is a tabular view of the results of the eight trials:

Cubic feet of gas per ton of coal.	Specific gravity of gas.	Condensation by chlorine.	Durability jet $\frac{1}{33}$, 5 inch flame.	Argand having 58 holes consuming ft. per hour.	Illuminating power per foot= candles 120 grains.	One foot = grains sperm.	Gas per ton =lb. sperm.
39,893	434	6·05	35′ 45″	8·0	4·61	553·2	3152·6
39,893	453	9·33	40 50	8·0	5·25	630·0	3590·0
39,893	536	11·00	43 00	9·0	5·13	615·6	3508·0
38,986	646	12·00	46 40	7·2	5·46	655·2	3649·0
38,986	666	11·00	44 10	7·2	4·08	489·6	2726·5
39,893	663	12·75	46 00	7·2	4·85	582·0	3316·8
39,896	600	11·33	46 30	7·5	5·02	601·2	3426·5
38,986	606	11·25	42 40	8·3	3 05	420·0	2339·0
39,553	575	11·44	43 20	7·8	4·73	568·5	3213·5

In the two first and the two last of these trials, the production of gas was continued till the desired quantity was obtained. In the others, it

was carried on during the same, or nearly the same length of time, that by previous trials was found to be necessary for carbonizing the same quantity of coal alone. In these instances, the water was more rapidly propelled through the retorts than in the others, especially towards the commencement of the process.

These trials show that the process is very uncertain in its results, even when it is conducted under similar circumstances. The average of all the above mentioned trials is, that from a ton of Boghead coal by the water process, there are obtained in this way 39,553 feet of gas, each foot of which gives the light of 4·73 candles, burning 120 grains per hour; that is, 561·5 grains of sperm, making the gas from a ton of coal give the light of 3213·5 lbs. of sperm.

These results may be considered as what the hydrocarbon process will yield; indeed, they nearly correspond with those given by Dr. Frankland and Mr. Clegg; for, though the quantity of gas is inferior, yet the illuminating power of each foot is superior, and thus the pounds of sperm per ton of coal are nearly the same.

Dr. Frankland, in his Report, (*Journal of Gas-Lighting*, January, 1852,) states that from Boghead cannel he obtained 13,240 feet of gas per ton, the illuminating power of which per foot was 10·52 candles of 120 grains; consequently, each foot was equal to 1262·4 grains, and the gas of the ton was equal to 2387·7 lbs. of sperm. In my trials the average was 3213·5 lbs. per ton; therefore, 34 per cent. beyond his. From Boghead and water Dr. Frankland got 51,720 feet per ton, the illuminating power of which was equal to four candles per foot; and the total quantity was, therefore, equal to 3546·5 lbs. The average of my trials was 3213·54 lbs.

Mr. Clegg, in his Report, published after most of the foregoing trials were made, has given very nearly the same results. He obtained 52,000 feet of gas from a ton of Boghead coal by the action of water, each foot of which was equal to four candles—that is, to 480 grains of sperm; the total quantity was, therefore, equal to 3515·7 lbs. We may, therefore, consider the results of my trials as correct; and thus confirming to a certain extent, those of Dr. Frankland and Mr. Clegg; viz., that from a ton of Boghead coal, by the action of water, a quantity of gas can be obtained which, when properly consumed, will give the light of about from 3200 lbs. to 3400 lbs. of sperm. They differ, however, from them in two very important points; my gas, by the water process, though giving about the same light, was not nearly so great in quantity; it was about 24 per cent. less. Again: in Dr. Frankland's trials, the quantity of gas from Boghead coal amounted only to 13,240, and the pound of sperm to 2387·7 per ton of coal. The increase in quantity of light, by the water process, was, therefore, 47 per cent. In my trials, though the amount of sperm per ton was in some a little more, yet *the average of all the trials gave a little less by the water process than by Boghead alone.* I think that this may be satisfactorily accounted for by the low results obtained by Dr. Frankland from the Boghead coal. I have never had a smaller quantity than 14,200 feet per ton, with one exception, in which case it was only 13,370 feet. Of twelve trials, the quantity varied from 14,200 to 17,680 feet. This may be owing to the low heat at which the gas was driven

off by Dr. Frankland, and which he states is the best, both for the coals alone and for the production of gas by the water process. On the contrary, I have found the best results are got from Boghead coal by using a heat higher than usual. The best result I ever had was that in which the heat was *very high.* In that case I got 17,680 feet; and, what is remarkable, the illuminating power of the gas was also higher; it was equal per foot to 12·12 candles of 120 grains; that is, equal to 2676 lbs. of sperm per ton of coal—a quantity *beyond that got by Dr. Frankland by the water process.*

The above remarks apply solely to trials with Boghead coal, so as to obtain from it a large quantity of gas, the illuminating power of which will be about 4 or 4·5 candles per foot; and, in my opinion, they are sufficient to warrant the conclusion, that though there is an increase in the quantity of gas per ton of coal by the water process, which no one ever doubted, yet that *there is no increase in light from the gas of a ton of coal compared with that obtained in those instances in which the carbonizing of the coal alone is properly conducted.*

Admitting the accuracy of the conclusion to which I have come, and which, in my opinion, the results of my trials warrant, I have next to consider whether there may not be a gain by obtaining a much larger quantity of gas, even though it is of inferior illuminating power.

The results of the trials which I am now to give, were conducted on a smaller quantity of coal, in the same apparatus. The heat of the water retort was kept high, to enable me to pass through it the requisite quantity of water, which, as has *been recommended*, was propelled as rapidly as could be done, towards the commencement of the process. The following are the results of five trials :—

Cubic feet of gas per ton of coal.	Specific gravity of gas.	Condensation by chlorine.	Durability jet $\frac{1}{33}$, flame 5 inch.	Argand feet per hour.	Illuminating power per foot = candle 120 grains.	One foot = grains sperm.	Gas per ton = lbs. sperm.
			m. s.				
52,133	466	5·75	35 20	8·0	2·01	252·	1876· 8
52,359	466	6· 5	35 30	9·0	1·91	229·6	1717· 4
52,352	460	6· 0	33 50	9·0	2·06	240·8	1801·14
51,680	460	5·25	35 00	9·0	2·11	253·4	1870·96
51,680	460	5· 5	34 10	9·0	1·81	217·	1602·
52,042	462	5·08	34 40	8·8	1·99	238·56	1773·06

These trials prove satisfactorily that there is, by this mode of operating, not only no gain, but actually a loss of light *to a very great extent.* From a ton of Boghead coal alone I got gas, the light of which was equal to 3253·5 lbs. of sperm. By this process, though the quantity of gas was great, yet the light of that gas per ton did not exceed 1773·6 lbs. of sperm, showing a loss of 1479·8 lbs. of sperm on the whole quantity—that is, 46 per cent.

Dr. Frankland states that he got 51,720 feet of 4 candle gas from a ton of coal, by the hydrocarbon process; making the pound of sperm per ton

equal to 3546·5. The gas of a ton of Boghead alone was in his experiments equal to 2387·7 lbs. of sperm, there being, therefore, according to him, an increase in the amount of light of 1158·8 lbs. of sperm—that is, of 48 per cent. In my trials, instead of an increase, there was a loss of 1772·3 lbs. of sperm on the whole quantity—that is, of 46 per cent.

How are we to reconcile these discordant results? I have already stated that, while Dr. Frankland got gas from Boghead alone equal to 2387·7 lbs. of sperm, I got gas equal to 3253·4 lbs. But Dr. Frankland's gas, when 51,720 feet per ton were obtained, was equal to 3546·5 lbs. of sperm; which, though an increase of 48 per cent. on the Boghead gas by his own trials, is only 9 per cent over the Boghead gas by mine. Why I have always had a loss instead of a gain, I cannot conceive. The only difference in the modes we have followed, in ascertaining the quality of the gases which we produced, is, that he received into his gasholder only a *part* of the gas as it was evolved from the coal, and of which gas only he tried the illuminating power; while I received the *whole* of the gas into my gasholders, and tested it. Surely my method is the more correct of the two, and claims more confidence in its results. Be this as it may, I conclude from these trials that, by the further use of water, no benefit is derived; indeed, that while the use of a small quantity of water does little harm in diminishing the amount of light, the use of a large quantity of water, with the view of procuring a large quantity of gas, proves injurious to a considerable extent. In further proof of this I give only one trial. In it the illuminating power per ton of coal was reduced in a very great degree.

Gas per ton.	Specific gravity.	Condensation by chlorine.	Durability.	Argand feet per hour.	Illuminating power 1 foot=cand.	One foot =grains sperm.	Gas per ton=lb. sperm.
75,253	640	4·125	m. 29 s. 10	9	0·27	32·4	348·3

According to Mr. Clegg, 75,000 feet of gas, of 2·4 candles per foot, were got from a ton of Boghead—that is, equal to 2880 lbs. of sperm per ton. I could only get 345·5 lbs. How to reconcile these very discordant results I know not. I wish much that Mr. Clegg had stated the details of the process by which he succeeded in procuring this large quantity of gas, and how he ascertained the illuminating power. That there must be a great loss in all attempts to obtain a large quantity of gas from Boghead is evident. It is well known that, when this coal is carbonized at a low heat, it yields either a comparatively small quantity of gas, or, if the gas be in larger quantity, it is of low illuminating power. In trials with water, in which, with the view of obtaining a large quantity of gas, the water is propelled through the retort rapidly, to produce, as it is supposed, the full beneficial effect, the heat must be brought very low. Hence, probably, the cause of the loss in the illuminating power when we attempt to increase the quantity of gas.

Though, by the use of water to get a large quantity of gas from Boghead coal, there is no increase in the amount of light from the gas of a ton of coal, yet there may be some beneficial influence exerted when the

water is used, as to yield a much smaller quantity of gas. One trial was made in this way, and the following is the result:

Gas per ton.	Specific gravity.	Condensation by chlorine.	Durability.	Argand feet per hour.	Illuminating power 1 foot = candle 120 grains.	One foot = grs. sperm.	Gas of 1 ton = lb. sperm.
24,932	554	11·75	m. s. 48 20	6·8	6·51	781·2	2782·4

In this case, though the increase of gas amounted to 54 per cent., yet there was a loss of light in that obtained from Boghead alone to the extent of about 15 per cent.; still further proving that water not only does not exert any beneficial influence, but that, in most cases, it actually proves injurious, by reducing the total amount of light got from the coal in the usual way of carbonizing it.

The remark made regarding the uncertainty of the process is also still further proved by the above trial. It seems difficult so to regulate it as to obtain always the same results.

From what has now been said, I think I am still further warranted in coming to the general conclusion that, *in no instance is there any gain in the amount of light from Boghead coal gas by the agency of water in the method recommended by the advocates of the "hydrocarbon gas,"* and that, in those cases in which the quantity of gas is increased to a great extent, there is a decided loss by the agency of the water.

(To be continued.)

Specification of the Patent granted to George Gwynne, *of the County of Middlesex, England, for Improvements in the Manufacture of Sugar.* Sealed February 27, Enrolled August 27, 1850.*

The first part of my invention will be found sufficiently detailed in the following description: a suitable oxide of lead, say for example, "litharge," is moistened with water, and is then subjected to a process of grinding until it is reduced to a smooth paste. When this is accomplished, twice its weight of refined sugar is added to it, and the grinding continued until these materials are properly combined. This result may be ascertained by putting a small portion of the mixture into a glass, stirring it up with some water, and after a few minutes upon slowly pouring it away. If the operation is perfect, no oxide of lead in a free state will be found at the bottom of the glass. This combination for distinction sake I shall call saccharate of lead. During the grinding, water is to be added from time to time, for the purpose of keeping the materials in a state of moderate consistency, and the generation by friction of such a degree of heat as will darken the sugar should be avoided. When the lead and sugar have properly combined, the mixture should be allowed to remain for forty-

* From the London Repertory of Patent Inventions, No. 705.

eight hours, when the saccharide of lead will be fit for use. During this latter period it may be well stirred up two or three times.

The application of this agent for the purification of saccharine matters is carried on as follows, but the details may be varied.

Some of the saccharide of lead is to be worked up with water to the consistence of cream, and passed through a fine sieve into the "blow-up" or other clarifying vessel.

The raw sugar with the necessary quantity of water is then to be added and the whole mixed together, when the steam or other heat is to be applied until the necessary temperature is attained, which my experiments lead me to consider is two hundred and twelve degrees of Fahrenheit, although it is possible that on the large scale a lower heat, say one hundred and eighty, may be found sufficient. The solution of sugar is now to be filtered through a bag-filter or other suitable filtering apparatus, and when perfectly transparent ("bright") is to be received into a suitable cistern.

In operating on cane juice, beet root juice, &c., I would advise the saccharide of lead to be substituted for the lime or carbonate of lime at present used. When the necessary quantity of this agent has been added, the juice is to be brought to the boil, and then filtered through a bag-filter or other suitable filtering apparatus.

It is, perhaps, unnecessary for me to observe that the quantity of saccharide of lead to be used will depend upon the quantity of the raw material; a little experience will enable the operator to ascertain the requisite proportion. I recommend that a trial should be made in the first instance at the rate of forty pounds of dry litharge to one ton of raw sugar of fair quality, and this proportion may afterwards be increased or diminished with other quantities of the same sugar to suit the manufacturer. As the impurities are more easily precipitated from cane juice, &c., than from raw sugar, it may be advisable to use a smaller proportion of saccharide of lead than is recommended above when operating on such saccharine matters.

After filtration it is necessary to remove a quantity of lead which has got into solution in the bright liquor or juice. There are several chemical agents, such as sulphuric acid, oxalic acid, hydro-sulphuric acid gas, sulphurous acid gas, acidulated ferro-cyanide of potassium, phosphate of lime, binoxalate of potassa, &c., which will render insoluble the lead. I however give the preference to a certain mixture, which can be made in the following manner:—

Calcined bone, "bone-earth," or "bone-ash," in fine powder, is to be well washed by repeated affusions of boiling water. The bone-earth is then to be made into the consistence of thin paste, and two-thirds of its weight when dry of sulphuric acid, previously diluted with four volumes of water, is to be slowly incorporated with it. These materials are then to be simmered for about 12 hours, frequent stirring being resorted to, and from time to time a little water is to be added as it evaporates away.

At the end of this time as much water is to be added as will reduce the mixture to the consistence of cream, when the whole is to be thrown into a conical linen bag to separate the clear fluid, and the residuum washed till the water ceases to taste acid. The strained fluids obtained as above are

then to be evaporated to about half their bulk, and when cold are to be filtered, and the filtered fluid is to be evaporated to dryness in a glass or other suitable vessel, and the mass resulting therefrom is to be heated to a dull redness for an hour in a platinum basin, and when cold is to be reduced to powder.

This powder is to be boiled with some water in a platinum or other suitable vessel; for two vessels constant stirring being employed, and water added from time to time as it boils away, and then to be filtered, and the residuum to be washed with boiling water till the water ceases to taste acid.

The different fluids obtained from the powder are then to be mixed together and brought to the boil, when a thin "cream of lime" is to be slowly added, stirring well at the same time, and continuing the boiling until a slight opacity appears, when filtration is to take place. The clear fluid solution of phosphate of lime, now obtained, is to be slowly stirred into a weak, say one part of soda and twenty parts water, and boiling solution of carbonate of soda until a very slight acidity is produced.

The white precipitate produced in the soda solution by the phosphate of lime is to be allowed to subside, when the clear fluid is to be drawn off, and evaporated to the point at which it begins to show crystals when quite cold. It is then to be mixed with the white precipitate above mentioned; this mixture, for distinction sake, I shall call phosphate of soda and lime; and, though I consider it the best agent for rendering insoluble the lead contained in the bright liquor or juice, I do not mean to confine myself to its use. I shall now describe the manner in which it may be applied.

I shall suppose the bright liquor or juice to have been received into a copper vessel, with a "steam jacket," and that the temperature of the fluid is about 180 degrees of Fahrenheit. Now mix in gradually as much of the phosphate of soda and lime as will render insoluble the lead.

The liquor or juice is now ready for filtration, but before this operation is performed it will be necessary to determine positively that the whole of the lead has been rendered insoluble.

After it has been ascertained by testing, as is now well understood, that the whole of the lead has been rendered insoluble, the liquor or juice is to be filtered through a bag filter, or other suitable filtering apparatus, for the purpose of removing the insoluble lead. The filtered liquor or juice may now be transferred into the vacuum pan or other suitable evaporating vessel, and at once converted into sugar, or, as a preliminary step to this conversion, the liquor or juice may be filtered through beds of coarse grained charcoal, in the manner now practised in many London refiners'.

Before I conclude the description of this part of my invention, I think it necessary to observe, first, that raw sugar may be used, instead of refined sugar, in the preparation of what I have called the saccharide of lead; secondly, that the saccharide of lead may be made by other processes than the one described by me, as, for example, by boiling together litharge, sugar, and water; thirdly, that the smooth parts mentioned in the early part of this specification, and which for distinction sake, I shall

call lead paste, is a powerful precipitator of the impurities contained in saccharine matters; and fourthly, that, although I do not recommend them, hydrated oxide of lead and oxide of lead itself may be employed for the purification of raw sugar, cane juice, &c.

When the lead paste is employed for precipitating the impurities from saccharine matters, it is to be used in the manner described for the saccharide of lead; but, like this agent, the details may be varied.

The hydrated oxide of lead can be prepared by dropping a weak solution of nitrate of lead (stirring well at the same time) into a weak solution of caustic potassa, leaving the latter very slightly in excess, throwing the precipitate in a filter to drain, and afterwards washing it with cold water, for the purpose of carrying away the nitrate of potassa. After being thus obtained, it may be used for the purification of saccharine matters, in the manner described for the saccharide of lead.

Although oxide of lead has little or no effect on the impurities of raw sugar when used in the manner described for applying the saccharide of lead, still it can be made to act strongly on these foreign bodies; as for example, by mixing together one part of finely powdered litharge, twelve parts of water, and twenty-four parts of raw sugar, and evaporating these materials with constant stirring in a water bath, until they attain the consistency of a very thick syrup, when they should be diluted by water to the density of thirty degrees of Beaume's saccharometer, at the temperature of 180, and then filtered. A good liquor will thus be obtained.

I will now describe the second part of my invention, which consists of a mode or modes of preparing and using the basic acetates of lead, or other combination of lead and acetic acid.

The lead paste acetate of lead (or an equivalent proportion of acetic acid) is to be added, in the proportion of about three parts of dry litharge to one part of acetate of lead; and these materials are to be prepared and used in the manner before described for the preparation and use of the saccharide of lead, although the details may be varied. These proportions give the highest basic acetate (hexacetate) known to chemists, but I think it necessary to observe, first, that a still smaller proportion of acetate of lead than above mentioned may be used; secondly, that the grinding up together of these ingredients is not indispensable, as an analogous result may be produced by introducing separately into the liquor or juice the lead paste and acetate of lead or acetic acid, as for example, by putting into the blow-up or other clarifying vessel containing the raw sugar or juice, some acetate of lead or acetic acid, and afterwards adding lead paste; thirdly, that hydrated oxide of lead may be substituted for the lead paste; and fourthly, that it is not absolutely necessary to prepare either the lead paste or hydrated oxide of lead, as oxide of lead itself may be substituted for these bodies, although not in my opinion with advantage.

I will now describe the third part of my invention, which consists of an improved mode of rendering insoluble the lead contained in the bright liquor or juice when the basic acetates of lead, sub-acetate of lead, for example, have been employed to purify the raw sugar cane, &c.

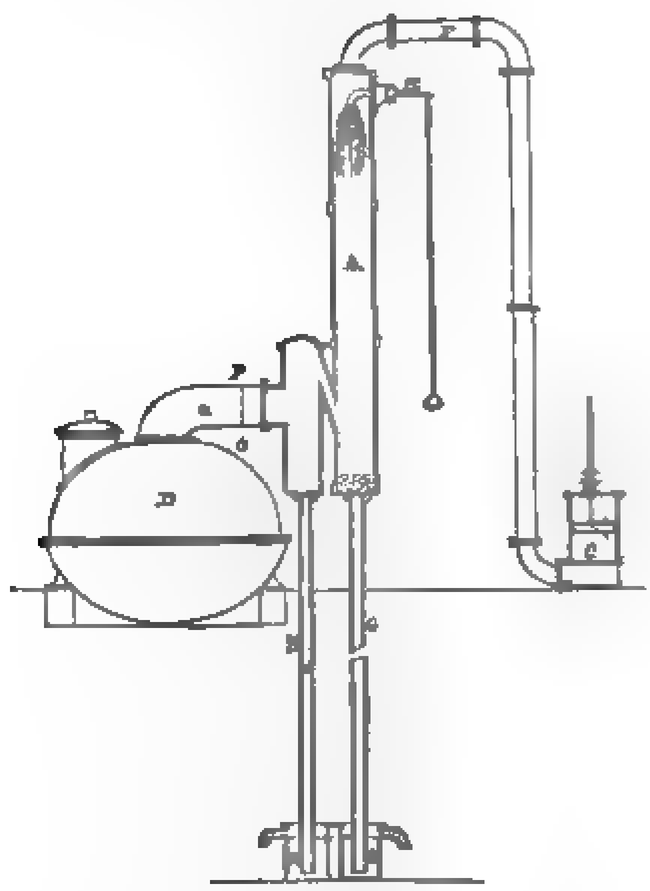
The agent which I prefer for this purpose is prepared in the same manner as the phosphate of soda and lime mentioned in the first part of

my invention, with this difference, that it is made slightly alkaline instead of slightly acid. This mixture, for distinction sake, I shall call alkaline phosphate of soda and lime, and it is to be used as follows, although the details may be varied.

I shall suppose the bright liquor or juice to have been received into a copper vessel with a "steam-jacket," and that the temperature of the fluid is about 180 degrees of Fahrenheit. Now mix in gradually as much of the alkaline phosphate of soda and lime as will render insoluble the lead.

The liquor is juice, and is now ready for filtration, but before this operation is performed it will be necessary to determine positively that the whole of the lead has been rendered insoluble.

After it has been ascertained by testing, as is now well understood, that the whole of the lead has been rendered insoluble, the liquor or juice is to be filtered through a bag filter, or other suitable filtering apparatus, for the purpose of removing the insoluble lead, and afterwards the liquor or juice may be converted into sugar.



Before I conclude the description of this part of my invention, I think it necessary to observe, first, that the phosphate of soda and lime may be used, instead of the alkaline phosphate of soda and lime. Second, that what I have called the white precipitate, which is produced in preparing the above phosphates, may be used in a manner different from that directed by me, as, for example, the clear fluids contained in these phosphates may be added to the bright liquor or juice first, and the white precipitate afterwards. Third, that the above phosphates, instead of being made slightly acid and slightly alkaline, may be made neutral. Fourth, that ammonia or potassa may be substituted for the soda contained in the above three phosphates; and, fifth, that the phosphates of soda, potassa, or ammonia, may be used as substitutes for the phosphate of soda and lime,

the alkaline phosphate of soda and lime, and the neutral phosphate of soda and lime.

I will now describe the fourth part of my invention, which consists of improvements in the vacuum pan, as referred to in the drawing. D, the vacuum pan; B, the receiver; H, a pipe inserted into the bottom of the receiver, B, and thirty-four feet long. It is shown broken in the drawing. This pipe dips into the small box, R, filled with water. A, the condenser; E, the injection cock for the admission of cold water; C, the air pump; F, the pipe of communication between the air pump and condenser; G, a pipe inserted into the bottom of the condenser, A. It is of the same length as the pipe, H, and dips into a similer box, Q, filled with water.

The following description will explain the mode of action:—Any liquor which boils out of the vacuum pan, D, falls into the receiver, B, and from thence down the pipe, H, into the box, R, from whence it flows away into some suitable receiver. The stream from the liquor in the vacuum pan, D, passes into the receiver, B, and from thence into the condenser, A, where it meets the injection water coming through the injection case, E, by which it is condensed, and falls to the bottom of the condenser, A, and passes from thence through the pipe, G, into the vessel, Q, from whence it runs away.

As the whole of the steam which is produced in the vacuum pan, will be condensed by the means above described, it must be obvious that nothing but the air contained in the liquor, or the air coming through leakages in the vacuum pan, can pass through the pipe of communication, F, into the air pump, C.

As there may be sugar houses where there is not a sufficient height to enable these improvements to be carried out in the manner shown in the drawing, the following substitutes may be used:—First, instead of the long pipes, G and H, small pumps may be applied in their places. Second, the exhaust arm, Z, of the vacuum pan, D, may be carried up such a height as will give the necessary elevation for the condenser, A, and the receiver, B. For the purpose of preventing any condensation in the exhaust arm, Z, it might be increased in another pipe between which steam might be admitted.

I am aware that it has been proposed to condense the steam arising from the vacuum pan by injection water passing through a pipe similar to the pipe, G. Now my improvements consist in the combination of the long pipes, and the air pump, or in the combination of the air pump and two small pumps used in the manner described above.

Having thus explained my invention, I wish it to be understood that I do not claim generally the use of basic acetates of lead in the manufacture of sugar; neither do I claim generally the separation of insoluble lead from saccharine matters by filtration through bag or other filters.

But what I claim is,

First, the use and application of saccharide of lead, whether prepared in the manner hereinbefore described, or in any other manner, of lead paste, and of oxide of lead, in the manufacture of sugar, and the use and application of suitable chemical agents for rendering insoluble the lead left in the bright liquor or juice through the use and application of saccharide of lead, whether made in the manner herein described, or in any other manner, of lead paste and oxide of lead. And I also claim the use of bag or

other filters for separating insoluble lead contained in the bright liquor or juice when such lead has been introduced through the use of hydrated oxide of lead.

Secondly, I claim the means herein described of preparing and using basic acetates of lead, or other combinations, lead, and acetic acid, in the manufacture of sugar.

Thirdly, I claim the means herein described of rendering insoluble the lead left in the bright liquor or juice when the basic acetates of lead have been employed to purify the raw sugar cane, juice, &c. And I also claim the separation of insoluble lead produced in the bright liquor or juice in the manner herein described by filtering the saccharine matters containing such lead through bag or other filters.

Fourthly, I claim the improvements herein described in the combination and working of vacuum pans.

---

*Boiler Explosion.**

London has usually been very free from boiler explosions, although a great proportion of the engines in it are worked with high pressure steam. We regret, therefore, to have to record a very disastrous explosion which occurred on the 2d instant, at a saw mill at Wapping. The circumstances were rather peculiar. The boiler was of the belt shape, cylindrical, with flue through of $\frac{7}{16}$ plates; the ends were strongly stayed, the water was not low, and the pressure was only about 16 lbs. per square inch. The shell was 6 feet diameter, and we should have had no hesitation in working such a boiler to 40 or 50 lbs per square inch. Many boilers about Manchester, of 8 or 9 feet diameter, and the same thickness of plates, are doing so with great safety. In this case the bottom of the shell had become corroded, where it rested on the ridge of brick-work separating the two flues, to such an extent, that in many places not an eighth of an inch of sound metal was left. The boiler had given signs, by excessive leakage for several months, that the bottom was in bad condition, and it had been patched, but no investigation of it by any competent person had taken place. *Had the boiler been tested in its place by hydraulic pressure to 30 lbs. on the inch, the accident would never have happened, two lives would have been saved, and the proprietor would have been several thousand pounds the richer.* Such a scene of devastation as it occasioned it has never been our lot to witness before. Similar explosions have taken place at Burnley and Worcester, during the last few days, in both of which we suspect shortness of water will prove to have been the cause.

Self-Acting Plugs for Boats.†

To the Editor of the Artizan.

SIR:—The recent sacrifice of life which attended the loss of the *Amazon* and *Birkenhead* has called forth, among other inventions, that of a self-acting plug for boats.

* From the London Artizan for September, 1852.

† From the London Artizan, September, 1852.

The valve of Lieut. Stevens* has been put in practice, but it is disapproved of by some, in consequence of the centre bolt getting screwed too tight, or, from the swelling of the leather disk, the upper table of the valve cannot be turned round; after trial, they were rejected by the West India Mail Company for this defect.

Another valve (or plug) has been invented by Mr. Lisabe, which consists of a brass box perforated, containing a ball, which, when the boat is immersed, is pressed against an India-rubber seating, and the water is thus kept out of the boat; and when the boat is suspended in the davits, the ball falls by its own gravity, and allows the water to escape.

As this design is very similar to one which I formed some months ago, in connexion with a scheme for lowering ships' boats, I am tempted to commit it to print, because I think it is less complicated in its construc-

Fig. 1.

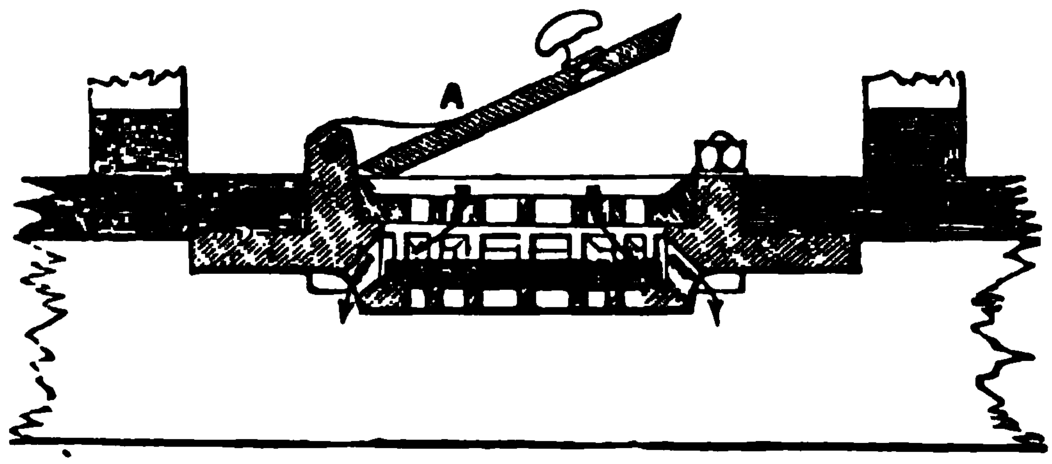
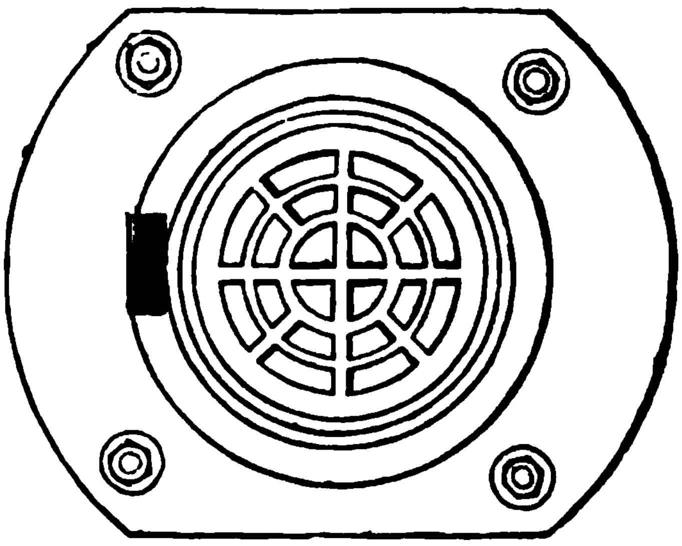


Fig. 2.



tion than that of Mr. Lisabe's. Fig. 1 is a sectional elevation, and fig. 2 a plan, with the upper lid, A, removed. The lower casting forms a shield and face to the India rubber disk, B, and flanch for bolting to the bottom planks of the boat; the upper face is screwed into the lower one, as shown, whilst the lid, A, fits into the top of the upper face or shield.

When the boat is suspended in the davits, the disk, B, will fall on to the lower face, and allow the water to escape through the sides, in the direction of the curved arrows; and when the boat is in the water, the disk will be floated and pressed against the upper face, and the water will thus be effectually kept out; the lid, A, is provided for the purpose of keeping in the water, when it is necessary to clean the boat. India rubber has now been used for several years for marine engine air pump buckets, in an exactly similar manner, with the most perfect success; and there can be no reason why it should not act in the present case.

* See Artizan, 1850, p. 259.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DECEMBER, 1852.

CIVIL ENGINEERING.

On the Expansion of Isolated Steam, and the Total Heat of Steam. By Mr. Charles W. Siemens.*

The object of this paper is to lay before the members the results of certain experiments on steam, purporting, in the first place, to corroborate Regnault's disproval of Watt's law—"that the sum of latent and sensible heat in steam of various pressures is the same;" in the second place, to prove the rate of expansion by heat of isolated steam; and, in the third place, to illustrate the immediate practical results of those experiments in working steam engines expansively.

The amount of heat required to convert one pound of water into steam of different pressures, has occupied the attention of natural philosophers from the earliest periods of the modern steam engine. Dr. Black observed, about a century ago, that a large quantity of heat was absorbed by water in its conversion into steam, (not accompanied by an increase of temperature,) which he termed "the latent heat of steam." His apparatus consisted simply of a metallic vessel containing water, which he exposed to a very regular fire; and from the comparative time which was occupied, first in raising the temperature of the water to the boiling point, and, secondly, in effecting the evaporation, he approximately determined the amount of latent heat. Resuming the experiment, in conjunction with Dr. Irvine, he employed a different apparatus, consisting of a steam generator, and of a surface condenser, or a serpentine tube, surrounded by a large body of cold water. The steam which condensed in the serpentine tube was carefully collected and weighed, and the rise

* From the London Journal of Arts and Sciences, September, 1852.

of temperature of the surrounding water was observed, which, multiplied by its known quantity, represented the total quantity of heat which the steam had yielded.

The quantity of heat requisite to raise the temperature of one pound of water through 1° Fahr., being taken for the unit of heat, Black and Irvine obtained for the total quantity of heat in

Steam of atmospheric pressure, the number,	954
Southern,	1021
Watt,	1140
Regnault,	1145
Dr. Ure,	1147
Desprer, 1136, but later,	1152
Brix,	1152
Guy Lussac and Clement,	1170
Count Rumford,	1206

All of these eminent experimentalists employed essentially the same apparatus, and the differences between their results prove its great liability to error. Brix, of Berlin, was the first to investigate those errors, and to calculate approximately their effect upon the results obtained.

While such a large amount of labor and talent has been expended, to determine the latent heat in steam of atmospheric pressure, a far more important question seems to have been passed over with neglect, namely, What is the relative amount of heat in steam of various densities? Watt justly perceived the importance of this question, but contented himself with one experiment, upon which he based his law, "that the sum of latent and sensible heat in steam is the same under all pressures." Southern repeated the experiment, and found that steam of greater density contained absolutely more heat than steam of lower pressure, which induced him to adopt the hypothesis, that "the latent heat of steam was the same at all pressures."

Subsequent experiments and general reasoning seemed to be in favor of Watt's law, which enjoyed general confidence until it was attacked, only a few years since, by Regnault, of Paris, who proved, by a series of exceedingly elaborate and carefully conducted experiments, that neither the law of Watt nor that of Southern was correct, but that the truth lay between the two. The apparatus employed by M. Regnault may be said to be a refinement upon those previously employed, and with the advantage of Brix's labors, to determine the amount of errors, he seems to have succeeded in measuring the absolute amount of heat in steam of various pressures with surprising accuracy. The costly and complicated nature of the apparatus employed by M. Regnault, has hitherto prevented other experimentalists from repeating the experiment; and, in the mean time, practical engineers still continue to adhere to Watt's law.

Shortly after the publication of Regnault's experiments by the Cavendish Society, in 1848, the idea occurred to the author of the present paper that their results might be brought to a positive test by a simple apparatus, which he exhibited to the meeting in operation. It consists of an upright cylindrical vessel of tin-plate, surrounded by an outer vessel, filled with charcoal, or other non-conducting material. A steam pipe, with a contracted glass vein or nozzle, enters the upper part of the inner vessel, in a position inclining upwards, in order that the water of priming

from the boiler, and of condensation within the pipe, may return to the former, allowing only a small jet of pure steam to enter the vessel, where it suddenly expands, and communicates its temperature to the bulb of a thermometer, which is inserted through a stuffing box from above. The lower extremity of the inner vessel is connected on the one hand to a mercury gauge, and on the other to a condenser, by means of a stop cock to regulate the pressure. The pressure and temperature of the steam within the boiler being known, and the temperature of the expanded steam observed, it will be seen whether that temperature coincides with the temperature which is due to pressure indicated by the mercury gauge. If it did, then Watt's law would be confirmed; but since the temperature rises higher than is due to the pressure, it follows that the high pressure steam contains an excess of heat, which serves to *super-heat* the expanded steam. All losses of heat from the apparatus would tend to reduce the temperature, and be in favor of Watt's law; but it will be shewn that those losses may be entirely eliminated, and a true quantitative result be obtained. For this purpose, the pressure in the boiler should first be raised to its highest point, and the indicating apparatus be well penetrated by the heat: the fire under the boiler should thereupon be reduced, and observations made simultaneously, and at regular intervals, of the declining pressure within the boiler, and temperature of the expanded steam of constant pressure. The pressures being nearly equal, the fire under the boiler is again increased, and the observations continued until the maximum pressure is once more obtained; and the loss of heat by radiation, &c., may be correctly estimated, by a comparison of the two series of observations.

The second portion of this paper relates to the rate of expansion of isolated steam by heat, that is, steam isolated from the water from which it is generated.

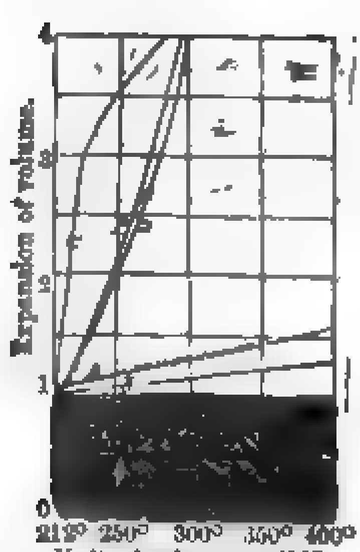
The author has not been able to meet with any direct experiments on this subject, except some at a recent period by Mr. Frost, of America, which, however, do not seem entitled to much confidence. The rate of expansion of air and other permanent gases by heat was first ascertained by Dalton and Guy Lussac simultaneously, who determined that all gases expanded uniformly, and at the same absolute rate, amounting to an increase of bulk equal to $\frac{1}{480}$th part of the total bulk at 32° Fahr. for every degree Fahr., or $\frac{1}{660}$th part of the total bulk at 212°. Dulong and Petit confirmed the law of Dalton and Guy Lussac; but it appears that these philosophers confined their labors to the permanent gases and atmospheric pressure, and merely supposed the general applicability of their discovery.

Being interested in the application of "super-heated" steam, the author tried some direct experiments on its rate of expansion, in the year 1847, which confirmed his view, that vapors expand more rapidly than permanent gases; or, in other words, that the rate of expansion of different gases and vapors is equal, not at the same absolute temperature, but at points equally removed from their point of generation.

The apparatus employed in these experiments consists of a metallic trough, containing oil, which is placed upon a furnace, heated by the flame of gas. One end of the trough is provided with a stuffing box,

through which a glass tube, of about $\frac{1}{16}$th inch diameter, and sealed at one end, may be slipped, and will rest horizontally upon a scale below the surface of the oil. The mouth of the glass tube is connected to an open mercury syphon, with either the one or the other leg filled with mercury, to produce the desired pressure within the horizontal glass tube. A small drop of water and a piston of mercury being introduced into the bottom of the tube, it is placed in the oil bath, and connected to the syphon. The oil bath is then gradually heated, and the temperature observed. As soon as the boiling point of water under the pressure in question is reached, the mercury piston will move rapidly forward, until all the water is converted into steam. The temperature continuing to increase, the piston will continue its course more slowly upon the scale, where its progress is noted from time to time, together with the temperature. The experiment is continued until the temperature reaches about 400°, when the oil begins to boil: the gas flame is then withdrawn, and the bath allowed to cool gradually. The observations of the temperature and the position of the mercury piston are continued until the steam contained behind it is recondensed. A comparison between the two series of observations gives the correct mean of the experiment, by which the effects of the friction of the mercury piston, any possible slight leakage of steam past it, and faults consequent on the slow transmission of heat, are completely neutralized.

The curve, A, on the diagram, has been drawn, expressing the rate of expansion of atmospheric steam according to these experiments. The results of nine separate experiments very nearly coincide (as shown by the dotted lines, which give the extreme variation in the experiments), except at the starting point, where the rate of expansion is so very great, that it is difficult to obtain correct observations: changes in the barometer, moreover, affect the curve in the vicinity of the boiling point. To obviate the effect of these inaccuracies, the unit of volume in laying down the curves from each of the nine experiments was taken, not at the absolute boiling point, but at 250°, where the expansion had already assumed a definite course.



Unit of volume at 212°.

The diagram also shows a straight line, B, expressing the rate of expansion of common air, which at first diverges greatly from the hyperbolic curve of expansion of steam, although the asymptote of the latter seems to run parallel to the former. The author considers it, therefore, highly probable, "that the rate of expansion of all gases may be expressed by one hyperbola, which starts from the condensing point of the gas," and that the apparently uniform rate of expansion of the permanent gases may be accounted for by their great elevation, at the ordinary temperature, above their supposed boiling point, in consequence whereof the true curve approaches so nearly to its asymptote that the difference cannot be detected by experiments.

The general result obtained from the above experiments may be stated

as follows:—That steam generated at 212°, and maintained at a constant pressure of one atmosphere, when heated out of contact with water to

230°	is expanded	5	times more	than air	would be.
240°	ditto	4	ditto		ditto.
260°	ditto	3	ditto		ditto.
370°	ditto	2	ditto		ditto.

The author intends to extend the range of his experiments upon gases and vapors under high pressure, and will communicate the further results to the Institution.

The diagram contains another curve, c, showing the results of Mr. Frost's experiments (alluded to before,) which, from the very sudden and irregular rise at the commencement, appears to be affected by some serious source of error.

The two curves of pressure and density, P, and D, show the rate at which saturated steam increases in pressure and in density with the rise of temperature marked at the bottom of the diagram. It will be observed that the pressure increases at a rather greater rate than the density; and it is a remarkable circumstance, that the difference, or the rate at which the pressure increases faster than the density (which is in effect the rate of expansion of saturated steam with the increase of sensible temperature), exactly coincide with the line, B, representing the rate of expansion of atmospheric air.

It has been theoretically demonstrated that a perfect Boulton and Watt condensing engine (abstracting friction and all losses of heat in the furnace and through radiation) would only yield about 7 per cent. of the mechanical force, which would be equivalent to the expanded heat. It may be argued from this, that the steam engine is destined to undergo another great modification in principle; and, in the author's humble opinion, this crisis will be accelerated by inquiries into those properties of gaseous fluids which have hitherto excited but little attention, and especially into the properties of dry steam, or isolated steam.

The present paper will be confined to shewing the effect of the above experiments upon the rate of expansion of steam within the steam cylinder of an engine. It was demonstrated by the first named experiments, that expanded steam is super-heated steam; and, by the second, it is shown what is the expansion of bulk due to an increase of temperature. Supposing the results of the experiments to be correct, the expansion curve as laid down by Pambour, and which is based upon Watt's law, requires a modification due to the excess of temperature in expanding steam, and it will be observed, that this correction in the curve of expansion is in favor of working engines expansively; as a greater average pressure is obtained during expansion than would be the case if the expanded steam were not thus super-heated. Its correctness is corroborated by some actual observations by Mr. Edward A. Cowper in taking diagrams of expansive engines, previous to his acquaintance with the above experiments. It moreover appears, that in Cornwall engineers have been practically acquainted with the fact, that expanded steam is super-heated steam, and more economic in its use than saturated steam; for it is a practice with them to generate the steam at very high pressure, and to expand it down

to the required pressure previous to its reaching the steam cylinder. Another remarkable practical observation is, that a jet of high pressure steam does not scald the naked hand, while a jet of low pressure steam does, although the high pressure steam is the hotter substance. The cooling effect of a jet of high pressure steam is so powerful, that, as the author has been informed, ice has been actually produced in the heat of summer in America, by blowing a powerful jet of steam of 400 lbs. pressure per square inch against a damp cloth. This phenomenon may be explained by the perfectly dry and under saturated state of expanded steam, which with a strong tendency to re-saturate itself, produces a powerful evaporation on moist surfaces with which it comes in contact. The rapid rate of expansion of steam by heat, when still near its boiling point, proves the economy of heating the steam cylinder, either by a steam-jacket, or by the application of fire. It is, however, important to observe, that the specific heat of steam seems to diminish, the more the temperature exceeds the boiling point.

Mr. Crampton inquired whether the charcoal in the casing of the instrument would not get heated by the tube of high pressure steam passing through it during the experiment, and so super-heat the steam in the internal cylinder?

Mr. Siemens explained, that it was not possible for such an effect to take place, as the end of the steam pipe was exceedingly small, and was protected by a thick non-conducting casing. He had also observed several times during the experiments, that whenever any priming took place in the boiler, and a drop of water came out with the steam and fell on the bulb of the internal thermometer, the mercury fell immediately to 212°, or the boiling point of water, and remained steadily there for four or five minutes, until the whole of the priming water was converted into steam, when the mercury again gradually rose to its former temperature. This showed that the increased temperature above 212° in the internal cylinder was entirely due to the extra heat in the expanded high pressure steam, and not to any heat derived from the charcoal casing.

Mr. E. A. Cowper observed, that the only source of heat to raise the temperature of the charcoal casing, was the super-heat in the expanded steam in the interior of the cylinder; as the jet of high pressure steam was so small and well protected, that it could not have any appreciable effect in heating the charcoal: consequently, the charcoal casing could only attain the temperature of the expanded steam that was passing through it, and could not influence the temperature of that steam. In the first experiments tried by Mr. Siemens and himself, the lower end of the cylinder was entirely open to the atmosphere, so as to try the experiment with steam expanded down to the atmospheric pressure; and as the expanded steam was passing out into the atmosphere in a constant stream from the open mouth of the cylinder, it was impossible there that the increased temperature maintained in the cylinder could have been affected by the charcoal casing, and it could only have been due to the extra heat contained in the high pressure steam.

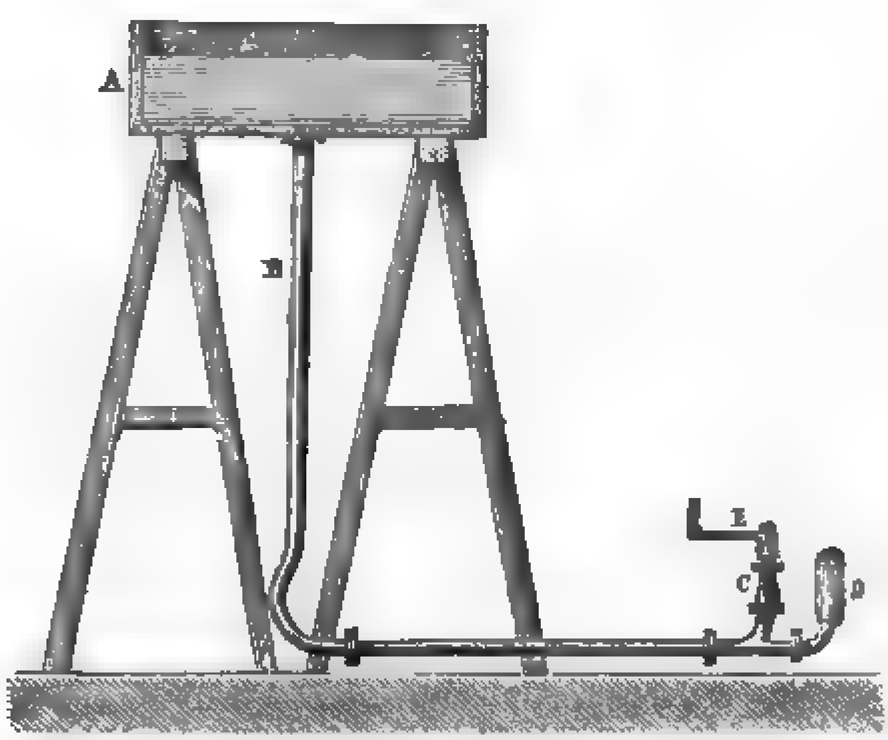
Mr. Siemens said, that as a check on the accuracy of the observations, he had tried them successively in an ascending and a descending series, when any error from the source alluded to would have been made appa-

rent and been doubled in effect; but he could not detect more than one degree difference in the observations.—*Proc. Inst. Mech. Eng., Birmingham, England.*

*On the Use of Air Vessels in Pumps.**

Some experiments have been made by Messrs. Kirchweger and Prusman, engineers, of Hanover, on the positive effect produced upon the action of pumps by the application of air vessels on the suction pipes. Air vessels have been applied for many years on delivery pipes, but it is only lately that their value has been properly estimated, although it is obvious that it is of as much importance that the pump should be filled with water, as that the delivery should be constant.

Fig. 1.



The apparatus employed by the German engineers is represented in section in fig. 1. A is a reservoir, which represents the source whence the pump draws its water, B is the suction pipe, and C is a valve-chest, containing a ball valve, surmounted by a cock discharging at the side. The plug of the cock is stationary, whilst the shell is moved by the handle, E. D is the air vessel.

Fig. 2.

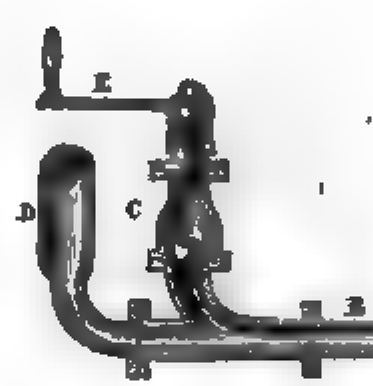


Fig. 2 shows the details of the valve on a larger scale.

It is obvious that, by causing the cock to revolve by means of the handle, E, a certain volume of water will escape each time the passage is opened, the height of water column in the pipe, E, answering to the pressure of the atmosphere in causing the water to fill the pump.

The result of the trials was that, when the air vessel was removed, and the opening stopped, an increased velocity of rotation of the cock gave less water; but with the air vessel the increase of velocity gave more water.

* From the London Artizan, October, 1858.

It is now easy to assign the quantities of caloric necessary to produce an equal volume of the vapor of each liquid at their respective boiling points, for these will obviously be represented by the expression

$$mc\{(t-50)+l\},$$

m being for each liquid its number in column 4, c its specific heat, t its boiling point, and l the latent heat of its vapor at the temperature of ebullition. When, with the aid of the annexed table—

	Boiling points.	Specific heats.	Latent heats.
Water, . . .	212·0°	1·00°	961·8°
Wood spirit, . . .	151·7	0·67	475·2
Alcohol, . . .	172·4	0·64	374·4
Ether, ...	100·4	0·50	163·8

which exhibits the specific and latent heats on which most reliance can be placed, the numerical calculation is made, the following are the results:

Water, ...	1129·0	1·000
Wood spirit, ...	764·8	0·676
Alcohol, ...	875·5	0·775
Ether, ...	534·7	0·473

The mere inspection of these numbers is sufficient to show that Mr. Ainger is in error, or that by substituting for water, wood spirit, alchol, or ether, the same moving force will be obtained, and with a great saving of fuel. With wood spirit about two-thirds, with alcohol about three-fourths, and with ether somewhat less than half the caloric required by water will suffice.

To the use, however, of such liquids there are obvious objections. Their cost is considerable compared to that of water; and as they evolve at atmospheric temperatures vapors of a considerable elastic force, they will, from imperfect condensation, resist the descent of the piston, and thus give rise to an appreciable loss of power. But notwithstanding this practical difficulty, which by the way is not, in the cases of alcohol and wood spirit, one of a very formidable nature, the theoretic conclusion is no less certain, that equal volumes of the vapors of different liquids, formed at their respective boiling points under the pressure of a single atmosphere, *do not* require for their production equal quantities of caloric.

AMERICAN PATENTS.

List of American Patents which issued from Oct. 12th, to Nov. 2d, 1852, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

20. For *Improved Apparatus for Heating Feed Water of Steam Boilers;* Matthias W. Baldwin, Philadelphia, and David Clark, Schuylkill Haven, Pennsylvania, October 12.

Claim.—"What we claim as our invention is, the arrangement of a heater for the feed water of steam boilers, with respect to the chimney, smoke box, and the blast pipes of the escape steam, substantially as herein described; so that the heated smoke and gases from the smoke box, and the exhaust steam from the cylinder, shall pass separately through the heater, in distinct tubes or channels, in such manner that they cannot mix until both have passed the heater, as herein set forth."

21. For an *Improvement in Mill Stones;* Thomas Barnett, Beverly, England, October 12; patented in England, January 8, 1852.

Claim.—"I am aware that holes or apertures in upper and under mill stones have been some time in use, and I do not claim simply the making of holes or apertures in mill stones as my invention; but I do claim the making in under mill stones, of holes or apertures, covered with wire gauze cloth, perforated metal plates, or any other substance that will allow part of the meal to pass through, after it is sufficiently ground, in combination with holes or apertures in upper mill stones, containing sweepers, brushes, or rubbers, for the purpose of sweeping, rubbing, or brushing the meal over or through the wire gauze cloth, perforated metal plates, or other substances, without confining myself to the exact detail described in the above specification."

22. For an *Improvement in Gang Ploughs;* Charles Bishop, Norwalk, Ohio, October 12.

Claim.—"Having fully described the nature of my invention, what I claim as new is, the manner herein described of constructing the mould boards, and combining them with the blade, in the manner substantially as herein specified."

23. For an *Improvement in Sugar Boiling Apparatus;* William H. Clement, Philadelphia, Pennsylvania, October 12.

Claim.—"What I claim as my invention is, 1st, The arrangement and combination of the simmering vessel with the ball cock and the scumming trough, substantially as described in the first part of the foregoing specification; and I claim this arrangement and combination, whether alone, or in further combination with a partial covering of the bottom of the simmering vessel, or the introduction of the steam worm, as there described.

"2d, The agitator, arranged and operating in the manner and for the purposes substantially as described in the second and fourth part of the foregoing specification."

24. For an *Improvement in Scumming Apparatus for Sugar Pans;* William H. Clement, Philadelphia, Pennsylvania, October 12; patented in England, July 23, 1846.

Claim.—"In conclusion, I wish it to be understood that I claim as my invention, 1st, the application in the manufacture of sugar, of rotating paddles or leaves, for skimming or taking off the scum and gummous matters from the surface of the liquor."

25. For an *Improvement in Distilling Apparatus;* Charles Delescluze, City of New York, October 12.

"The nature of my invention consists in apparatus for distilling and rectifying spirits, without interruption and without the use of charcoal. I can distil by means of my apparatus, as pure a spirit as that which is imported into this country from Montpelier, France."

Claim.—"What I claim as my invention is, 1st, The combination and arrangement of the boilers, *a* and *p*, connected by the pipes, *b* and *l*, with the column, *z*, which enables me to work continually and without interruption, by distilling the contents of one boiler, while the other boiler is being filled, and thus distilling the contents of one boiler immediately after the other, as seen in the description of the work in the former part of this specification.

"2d, The combination and arrangement of the worm, *v*, situated between the two boilers, *a* and *p*, and of the pipes, *u* and *x*, which connect the boilers, *a* and *p*, with the worm, *v*, enabling me to test and ascertain the nature of the liquid contained in the boiler under operation, and to ascertain when the contents of that boiler are distilled."

26. For an *Improvement in Illuminating Gas Apparatus;* Robert Foulis, St. Johns, New Brunswick, October 12.

Claim.—"What I claim as my invention is, 1st, the return pipe, in combination with the retort, substantially as set forth.

"2d, I claim, in combination with the said pipe, the false bottom and lining, as described.

"3d, I claim the arrangement of the decomposing chamber, in combination with the return pipe in the vertical retort.

"4th, I claim the employment of the series of decomposing trays under the arrangement in the vertical retort, substantially as described, in combination with the central pipe.

"5th, I claim refrigerating the gas by air, substantially in the manner described."

27. For an *Improvement in Modes of Making India Rubber Bat Cloth;* Charles Goodyear, New Haven, Connecticut, October 12.

Claim.—"What I claim as my invention is, passing the bat or fleece of cotton, flax, silk, or other fibrous substance, together with dissolved or softened caoutchouc, gutta percha, or other vulcanizable gum, or the compounds or preparations thereof, between calendering rollers, with an elastic substance interposed between the bat or fleece and one of the rollers, as described, or between the glazed apron and one of the rollers, substantially as described."

28. For an *Improvement in Electro-Magnetic Engines;* John S. Gustin, Trenton, New Jersey, October 12.

"The nature of my invention consists in so arranging the electro-magnets and the parts connected therewith, that their great power of attraction, in close proximity, is continued through the required length of stroke of a reciprocating engine of large or small size."

Claim.—"What I claim as my invention is, supporting the principal part of the weight of the armatures of the electro-magnets, mounted upon sliding guides or their equivalents, upon the reciprocating frame, as described, by means of springs or their equivalents, attached to said frame, so as to preserve the balance of weight in the moving parts, substantially as set forth."

29. For an *Improvement in Safety Valves;* Alfred Guthrie, Chicago, Illinois, October 12.

Claim.—"What I claim as my invention is, the construction of the cock in the connecting pipe, by which the resistance to the pressure is taken off, and at which the steam will be allowed to escape."

30. For an *Improvement in Double Seaming Machines;* Walter Hamilton, Elmira, New York, October 12.

Claim.—"Having fully described the construction and operation of my improved machine, what I claim is, the mandrel, with heads removable at pleasure, in combination with two or more pressure rollers, operating with the same, and with a mallet acting simultaneously with said mandrel and pressure rollers.

"I also claim the adjustable steadying rollers or their equivalents, arranged with reference to the mandrel, and acting substantially in the manner and for the purpose herein set forth."

31. For an *Improvement in Hominy Mills;* James Hughes, Cambridge City, Indiana, October 12.

Claim.—"Having fully described the nature of my improved machinery for making hominy and samp, what I claim therein as new are, the combination of the beating cylinder, arranged and constructed as set forth, with the adjustable discharging apertures, by means of which the hulls and eyes are separated from the grain, and the latter is retained within the range of the beaters for a shorter or longer period, according to the grade or size of hominy or samp which is desired."

32. For an *Improvement in Presses for Bundling Flocculent and other Substances;* Daniel Kellogg, Pittsfield, Michigan, October 12.

"My invention consists of a peculiar construction and arrangement of the press box, bed, and platen, whereby the substance being pressed may be single and double, or cross bound, while under pressure."

Claim.—"Having thus described my improved press, what I claim as new therein is, the combination of the pressing box, made with openings in its sides, with the platen and bed, turning on swivels, and formed with channels, so arranged as to admit of the passage of the needle and cord through the pressing box, for the purpose of singly and doubly binding fleeces of wool or other substances, while under pressure."

33. For an *Improvement in Gas Regulators;* Walter Kidder, Lowell, Massachusetts, October 12.

Claim.—"Having fully described my improved gas regulator, what I claim therein as new is, producing a uniform pressure of gas in the branch pipe which supplies the burners, by means of the inverted cup, the vibratory lever, and the induction valve, arranged and operating within the chamber of the branch pipe, substantially as herein represented and described."

34. For an *Improvement in Gas Regulators;* Walter Kidder, Lowell, Massachusetts, October 12.

Claim.—"Having fully described my improved gas economizing regulator, what I claim therein as new is, producing a uniform pressure of gas in the branch pipe which supplies the burners—which may not be varied by the number of burners supplied, nor by the variations of pressure in the main—by means of the counterpoising double inverted cups, the vibratory lever, and the induction valve, so combined and arranged, with reference to the main and the branch pipe, that one of the said inverted cups will be acted upon by the gas in the main, and the other by the gas in the branch pipe, as herein represented and described."

35. For an *Improvement in Gas Regulators;* Walter Kidder, Lowell, Massachusetts, October 12.

Claim.—"Having fully described my improved gas economizer, what I claim therein as new is, the producing at all times a proper and uniform pressure of gas in the branch pipe which supplies the burners, which will not be essentially varied by the number of burners supplied, nor by the variations of pressure in the main, by means of the induction valve, the vibratory lever, and the counterpoising inverted cup, combined, and arranged, and operating within the chamber of the main, substantially as herein represented and described."

36. For an *Improvement in Harness Saddle Trees;* Thomas Mardock and William C. Kellar, Cincinnati, Ohio, October 12.

Claim.—"Having described the nature of our improvements in harness saddle trees, what we claim therein as new are, the crupper loop, having a shank, which being inserted through the cantle into the pommel, is secured to the latter by the pad hook, in the manner described."

37. For an *Improvement in the Apparatus for Transporting Trains on Inclined Planes of Railroads;* Samuel McElfatrick, Dauphin, Pennsylvania, October 12.

Claim.—"I do not claim as my invention dividing the axles of the car, and providing the inner ends of the two parts with independent journals, as this has before been done; neither do I claim the use of an auxiliary track, running down into a pit: but what I do claim as my invention is, making the axles of the safety car in two parts, the inner end of each part being provided with an independent journal, constructed and operated as described, when this is combined with the auxiliary wheels and auxiliary converging track and pit, substantially in the manner and for the purpose specified."

38. For an *Improvement in Grinding Mills;* Oldin Nichols, Lowell, Massachusetts, October 12.

Claim.—"What I claim as my invention is, the pointed projections on the front edges of the teeth of the cylinder, when used in combination with the teeth in the concave formed with concavities in their front edges, substantially in the manner and for the purpose herein set forth."

39. For an *Improvement in Expanding Window Sashes;* Mighill Nutting, Portland, Maine, October 12.

Claim.—"What I claim as my invention is, the method of varying the pressure of the edges of the expanding sash against the jambs of the window frame, by means of the combination of the adjusting screws and springs with the set screws, or the equivalent thereof, for limiting the extent of the expansion of the sash, substantially as herein set forth."

40. For an *Improvement in Plough Fastening Devices;* James Robb, Lewistown, Pennsylvania, October 12.

Claim.—"I do not claim, exclusively of itself, hooking the land side of the mould board; but what I do claim as new and useful is, holding the share to its place by a tightening wedge, having a lip for lap or bite on the share, in conjunction with the headed or lip'd studs, for further securing the same."

41. For an *Improvement in Seed Planters;* James Robb, Lewistown, Pennsylvania, October 12.

Claim.—"I do not claim, exclusively of itself, giving to the drill tooth the curvilinear movement specified, as such is old; but what I do claim as my invention is, 1st, Causing the point of the drill tooth, when raised out of the ground, to slope backward, by the

arrangement of the drag bar attachment, the friction pulley, and the curve of the upper part of the drill tooth, to avoid breaking the tooth, as herein described.

"2d, I claim the combined device of endless screw and curved neck and pinion, for producing the result herein specified."

42. For an *Improvement in Burners for Spirit Gas Lamps;* Rufus W. Sargent, Philadelphia, Pennsylvania, October 12.

Claim.—"I do not claim the reservoir, burner tubes, or arrangement of the wick. What I claim as my invention is, the combination of the lower chamber or chambers with the upper chamber, for the purpose specified, viz: the lower chamber or chambers, answering the purpose of a heater, volatilize or turn into gas the fluid in the upper chamber, the flame being regulated as above described, and the whole arrangement being substantially as above set forth, without restricting myself by this claim to the precise form of the burner described."

43. For an *Improvement in Packing Water Wheels;* Erasmus Smith, Norwich, New York, October 12.

Claim.—"Having described my improved water wheel, what I claim as new therein is, the arrangement of the packing between the edges of the chamber or case and the wheels, in such manner that the packing on the lower portion of the chamber is adjustable from the interior, while the packing round the upper portion of the chamber is set up from the outside of said chamber, substantially as specified, so that the whole of the packing is on the upper side, and none of it under the case, and all capable of being set up or adjusted without the necessity of getting under the case."

44. For an *Improvement in Governors;* John Thompson, Buffalo, New York, October 12.

"The nature of my improvement consists in the use of cords, chains, rods, or their equivalent, when wound upon a spindle or otherwise, as hereinafter described, and combined with or attached to weights or fans, for the purpose of regulating the motion of steam engines, or for regulating the supply of fluids, &c."

Claim.—"Having described my invention and improvement in governors, what I claim as new is, the combination of the winding cords or chains, retarders or disks, hub, and spindle, arranged and operating in the manner and for the purpose substantially as herein set forth.

"I also claim operating the governor valve of steam and other engines, by the twisting and untwisting of a flexible cord or chain, or equivalent thereto, attached to revolving retarders, and to the driving pulley placed above the same, and detached from the spindle.

"I likewise claim constructing the clasp with shoulders upon each part, which fit against corresponding shoulders upon its opposite part, and prevent the opening of the clasp, when they are united by the screw, substantially as set forth."

45. For an *Improvement in Glass Buttons;* Arad W. Welton, Cheshire, Connecticut, October 12.

"My improvement consists in impressing upon a concave or underside of the glass centres of buttons, any desired figure, and painting or enamelling such figure with colors uniform or variegated."

Claim.—"What I claim as my invention is, the inserting of figures of uniform or variegated colors upon the inside of glass centred buttons, substantially in the mode above described."

46. For an *Improvement in Sewing Machines;* Otis Avery, Honesdale, Pennsylvania, October 19.

"The nature of my invention consists in using two adjustable spring needle bars, moving on the same plane obliquely towards each other from opposite sides of the cloth or other material to be sewn, for regulating the length of the stitch; also, the weight or its equivalent, for drawing through the cloth as fast as it is sewn and released by the needle, one of which is always in the cloth, to prevent it from being drawn entirely through."

Claim.—"Having thus fully described my invention, what I claim therein as new is, in combination with the needle bars, the spring holders and adjustable guides, through which the said bars pass, for the purpose of regulating the length of the stitch, substantially as herein described.

"I also claim, in combination with the apparatus for regulating the length of the stitch, the weight or its equivalent, for drawing the cloth forward, as it is alternately released

from the needles, by which means the feed motion is regulated and made dependant on the length of the stitch, substantially as described."

47. For an *Improvement in Spreading Lime and Manure;* Lewis Cooper, Coopersville, Pennsylvania, October 19.

Claim.—"What I claim as new and useful is, so constructing the pulverizing and fertilizing apparatus as to effect the several functions of pulverizing and distributing manures of various kinds at will, by so arranging the roller that it can be raised or depressed in the discharging opening of the bottom of the hopper to any required level, so as to discharge a larger or smaller quantity of material, previously brought to the desired degree of fineness in the hopper, and at the same time to act as a valve, to close more or less tightly the bottom of the hopper. The same roller likewise serving as a distributor of seed in sowing broadcast, without any alteration of the machine, substantially as herein set forth."

48. For an *Improvement in Tools for Cutting Pegs out of Boot Soles;* D. D. Allen, Adams, Massachusetts, October 19.

Claim.—"Having fully described the nature of my invention, what I claim as new is, 1st, the adjustable float or cutter, connected to a shank by means of the pin or pivot, which turns loosely in the bearing or standard, so as to permit the float to adjust itself to the proper positions to cut the pegs from the heel to the toe of the boot, in the manner herein set forth."

49. For an *Improvement in Grain Separators;* Peter Geiser, Smithsburg, Maryland, October 19.

Claim.—"What I claim as my invention is, the method herein described, of regulating the blast of winnowing machines, by means of a flap on the fan case, arranged and adjusted substantially as herein set forth.

"I also claim the reciprocating toothed bars, with the trough, whose bottom is divided into three portions, the lowermost being tight, and acting merely as a conveyor; the middle one acting both as a conveyor and screen, to separate the wheat from the straw, and allow it to pass into the winnower; and the upper or third portion acting as a conveyor for the straw, and a coarse screen, to separate therefrom the heads of unthreshed grain that would not pass through the lower screen, the teeth of the reciprocating bars moving the straw regularly along the trough, and working or shaking the grain and heads so effectually through the screens, that none is left to pass off with the straw when it is discharged from the upper end of the trough."

50. For an *Improvement in Printing Presses;* Lucius T. Guernsey, Montpelier, Vermont, October 19.

Claim.—"What I claim as my invention is, the combination of a reciprocating type bed, with an impression cylinder, which has the half-rotary (or reciprocating rotary) movement, and also a movement to and from the type bed, as herein set forth and described."

51. For an *Improvement in Seed Planters;* Edson Hart, New Albany, Indiana, October 19.

Claim.—"Having described the nature of my invention, what I claim therein as new are, the rail, with the rod or rods connecting it with the hopper, the said rods occupying traversing collars, with tightening screws, by means of which the relative distance of the axle and the feed shaft are adjusted, to suit different arrangements of gearing, according to the rate of feed desired."

52. For an *Improvement in Apparatus for Elevating and Discharging Bilge Water, &c.;* Nehemiah Hodge, North Adams, Massachusetts, October 19.

"The nature of my invention consists in combining with a series of tanks and tubes, or their equivalents, a ventilating or air tube, which has communication with the tanks for allowing the air to escape from the tanks as the water flows into them, the whole being so placed in the hold of a ship, or other sea-going vessel, for the purpose of elevating and discharging the water from the holds thereof, as that they shall be operated by the fore and aft or rolling motion of the vessel; thus making what I term 'a self-working ship's hydrant.'"

Claim.—"I am aware that rocker pumps have been constructed, to be operated by hand power; but in these no adequate provision has been made for receiving and retaining the water as it is raised up; besides, their action is limited to a continuous rapid propelling

power; whilst by my arrangement any varying inclination of the vessel from a horizontal line, however slow, puts the apparatus in operation, and as heretofore constructed, could not, without encumbering the hold of the vessel, be placed therein; I do not therefore lay claim to any such pumps: but what I do claim herein as new is, in combination with a series or system of tanks and tubes, or their equivalents, the ventilating tubes, substantially as described, for the purpose of elevating and discharging water from the holds of vessels; the whole being operated or worked by the motion of the vessel, as set forth."

53. For an *Improvement in Water Wheels;* Ira Jagger, Albany, New York, October 19.

Claim.—"I claim the application of an adjustable lip, sliding on the inner surface of the buckets of a turbine wheel, to regulate the openings between the outer edges of the buckets, and thereby the flow of water from the wheel, in manner and form substantially as set forth in the above specification, and thus adapting the lines of the turbine to the head of water and amount of work to be done, however varying."

54. For an *Improvement in making Soda Ash and Carbonates of Soda;* Henry Pemberton, Philadelphia, Pennsylvania, October 19.

Claim.—"Having fully described my invention and the means by which the same may be reduced to practice, what I claim therein as new is, 1st, the process of making soda ash by heating the mixture of sulphate of soda and carbonaceous matters, without the use of lime or any other foreign matters, as preparatory to converting the same into other products, substantially as described.

"2d, The process of treating the aqueous solution of the above heated products by carbonic acid, then boiling to dryness, to form a mono-hydrated carbonate of soda, to be treated again in the dry state, by carbonic acid, to form bi-carbonate of soda, as set forth in the specification."

55. For an *Improvement in Bedsteads;* Daniel W. Smead, Peru, Illinois, October 19.

"The nature of my invention consists in the construction of a movable or swinging foot board, that may be raised or lowered, and so as to hold the bed clothes in their proper places."

Claim.—"What I claim as my invention is, the swinging foot board, to serve the purpose of a clasp for securing the bed clothes, it being held down by a ratchet and pawl, or otherwise."

56. For a *Sash Stopper and Fastener;* James D. Smith, New Britain, Connecticut, October 19.

Claim.—"What I claim as my invention is, the construction of a window or sash stopper, operating by a winding spiral spring; the whole arranged and combined substantially as herein described."

57. For an *Improved Life Preserving Seat;* George P. Tewksbury, Boston, Massachusetts, October 19.

Claim.—"I claim the said improved life preserving seat, as made of a combination of the seat, the head or block, the air-tight vessel, and the connecting rods or grasping bars, applied together and used substantially in manner and for the purpose as specified."

58. For *Improved Burglar-Proof Plates for Doors, Safe Walls, Vaults, &c.;* Linus Yale, Jr., Newport, New York, October 19.

Claim.—"What I claim as new and of my invention is, a method of making burglar-proof plates, doors, and chests of iron, which, in the process of being cast into the form required for such plates, doors, and chests, surrounds or imbeds malleable iron rods or bars, or their equivalents, arranged substantially as described and shown by the specification and drawings herewith accompanied, or in an equivalent manner.

"I do not claim in said plates, doors, and chests, the casting in of straight rods or bars of malleable iron, or their equivalents, imbedded parallel with each other in only one general direction."

59. For an *Improvement in the Mode of Forming Crucibles and other Articles of Earthen Ware;* John Akrill, Williamsburgh, New York, October 26.

Claim.—"I do not limit myself to rotating the mould, as the cutter and burnisher may be rotated; neither do I limit myself to any particular character of earthy and plastic material of which the crucible is to be formed; what I claim is, 1st, the cutters on the stock in combination with the mould, to either or both of which a rotary motion is given, so as to remove the surplus material and shape the crucible, as described and shown."

60. For an *Improvement in Boot Crimps;* Luman Barrett, Gainesville, New York, October 26.

Claim.—"I do not claim as my invention the form of the brake, or of the clamps; but what I do claim as my improvement on crimping machines is, arranging a spring lever upon the back of the crimping lever, substantially in the manner and for the purpose herein set forth."

61. For an *Improved Bilt or Drill Stock;* Dexter H. Chamberlain, Boston, Massachusetts, October 26.

Claim.—"What I claim as my invention is, the improvement of combining with the bell crank, A, and handle, B, of the bitt stock, the rotary bitt holder or shaft, E, the shaft, K, the pulleys, M, L, and endless band, N, (or two gears as stated,) and the pulleys, G, I, and band, H, or gears, substantially as described, and for the purpose of accelerating the rotary motion of the drill beyond that of the bell crank, when the instrument is used as stated."

62. For an *Improvement in Gilding Daguerreotypes;* Charles L'homodieu, Charleston, South Carolina, October 26.

Claim.—"So far as I can ascertain, I am the first to succeed, in a practicable degree, in gilding daguerreotype plates with cyanide solutions; and the first to have gilded those plates at all with cyanide solutions and a single circle of zinc; I therefore claim my mode of gilding daguerreotype plates, substantially as described; that is to say, by the employment of the electric current, and of hot solutions of the cyanides of gold, previously boiled; and I claim the kind of zinc circle or tray designated by the figure 6."

63. For an *Improvement in a Machine for Making Bags of Paper;* Francis Wolle, Bethlehem, Pennsylvania, October 26.

"This invention consists in certain devices, by the combined operation of which, pieces of paper of suitable length are given out from a roll of the required width, cut off from the roll, and otherwise suitably cut to the required shape, folded, their edges pasted and lapped, and formed into complete and perfect bags, which, when dried, will be ready for use."

Claim.—"What I claim as my invention is, 1st, giving the proper form to the piece of paper or material from which the bag is to be made by means of the shears, and which cut on the edges of, or on edges attached to the stationary table or inclined plane on which the paper is delivered, and cut out a rectangular piece as shown in figures 6 and 8, from that part which is to form one side of the bag, so as to leave a lapping piece on the part which is to form the other side of the bag, as herein substantially set forth.

"2d, The pasters, in combination substantially as described, with the feeders, which revolve or pass through the paste, and supply them with a proper quantity for pasting each lap.

"3d, The combination of the creasers and the lappers, with the intermittingly moving feed rollers and aprons, in the manner substantially as described, the said creasers and lappers being brought successively into operation on the bags, during the intermissions in the motion of the feed rollers, as set forth."

64. For an *Improvement in Machinery for Combing Wool;* Samuel C. Sister, and George E. Donisthorpe, County of York, England, October 26; patented in England, March 20, 1850.

Claim.—"Having set forth our invention, we would have it understood that what we claim is the combination, the endless belt, and the rotary spring bar or bars, (or equivalent therefor,) operating as described, by which we draw the fibres from the gill combs, and carry them forwards to the revolving brush; the whole constructed and made to operate substantially as specified.

"And we also claim the peculiar manner in which the revolving brush, that takes the wool from the nipping apparatus and conveys it to and lays it upon a circular band or belt of upright teeth, is constructed and operated, the same consisting in making the said brush in sections, and combining therewith mechanism, by which not only a range of these sections can be thrown into a straight line with each other, but another and opposite range can be thrown into a curved or bent line, as herein before described, the said mechanism for effecting the movements of the sections of the ranges, being as hereinbefore explained and as represented.

65. For an *Improvement in Watch Keys;* Charles E. Jacot, City of New York, October 26.

Claim.—"I claim the key retained in a countersink in the back plate of the watch, by a spring or similar means, as herein set forth."

66. For an *Improvement in Hot Air Furnaces;* Augustus M. Rice, Assignor to himself and Sanford H. Lombard, Boston, Massachusetts, October 26.

Claim.—"What I claim as my invention is, the improved mode of making and supporting the grate, viz: by the combination of a single journal, a socket piece, and a crank key shaft, as applied to the furnace and grate, and made to operate substantially as specified.

"I also claim the peculiar combination and arrangement of the horizontal flues, the vertical flues, and the flue space surrounding the chamber of combustion, the whole being essentially as above specified.

67. For an *Improvement in Cooking Stoves;* Hosea H. Huntley, Assignor to David T. Woodrow, Cincinnati, Ohio, October 26.

Claim.—"What I claim as new is, giving the arched fire-plate great elevation above the level of the oven top on which its upper edge rests, and giving great capacity thereby to the air chamber formed by the arched fire-plate and oven plates; the under side of the arched fire-plate being furnished with ribs which divide this air chamber into flues transverse the stove, so that the full force of the fire draft is thrown upon the boiler openings and from the top plate of the oven, thereby protecting it from a surcharge of heat, and so that in concert with the flues around the ovens as described, the air must pass from the openings in the side plates to the centre, and thence back to the sides of the stove to the flues leading to the front of the stove, for the purpose of being thrown, very thoroughly heated and in great quantity, around the front oven, and when the damper is opened, around both ovens; it being distinctly understood that I do not claim a fire-plate in itself, nor ribs for guiding air along a fire-plate in themselves, but only my mode of pitching the arch of the fire-plate, and arranging the air chamber, in combination with the flues and damper, as described, so as to produce the aforementioned effect."

68. For an *Improvement in Hot Air Furnaces;* Apollos Richmond, Assignor to A. C. Barstow & Co., Providence, Rhode Island, October 26.

Claim.—"What I claim as my invention is, a spiral radiator, constructed substantially as above described, whether the pipes be of a round, square, or oval form in section, or the coils be round, square, or other shape."

69. For an *Improvement in Locks;* F. C. Goffin, City of New York, October 26.

"The nature of my invention consists in the employment or use of a guard, which, with the lever which intercepts the bolt, or prevents it from being withdrawn, rests or bears upon the tumblers; said guard requiring to be freed from the tumblers as well as the lever before the tumblers can be adjusted by the key so as to allow the lever to fall into the recesses in the tumblers, and enable the bolt to be withdrawn."

Claim.—"I do not claim the tumblers or the lever, for they are employed in many locks, and have been long known; but what I claim as my invention is, the employment or use of a guard, constructed, arranged and operating in the manner substantially as herein described, whereby the lock is prevented from being picked, by obtaining a pressure upon the bolt, as set forth."

70. For an *Improvement in Constructing Ploughs;* Albert Gardner, for himself, and as Administrator of the Estate of Wm. L. Hunter, deceased, Cincinnati, Ohio, October 26.

Claim.—"What I claim as the invention of the aforesaid William L. Hunter and myself, in the construction of the above described plough, is, bolting the standard mould board, landside, and share, to the block or its equivalent, instead of bolting or fastening the parts to each other, as has been practised heretofore, which block may be connected to the beam by a bolt, or otherwise, substantially as described and represented."

Re-issue for October, 1852.

1. For an *Improvement in the Seeding Apparatus of Seed Planters;* Lewis Moore, Bart, Pennsylvania; dated July 2, 1850; re-issued October 12, 1852.

Claim.—"Having fully described my improvements in seeding machines, I wish it to be understood that I do not claim a reciprocating gauge plate, having apertures parallel

and corresponding with apertures in the bottom of the hopper, as this I am aware is in use in other machines; but what I do claim as my invention is, the employment of a reciprocating gauge plate, when provided with feeding apertures in combination with corresponding apertures in the hopper bottom, which have their sides oblique to the sides of the apertures in the said reciprocating plate, and when combined with a device for giving it a variable reciprocating motion, for the purpose of sowing the seed constantly and uniformly, and varying the amount at pleasure, while the machine is moving, by simply varying the extent of its reciprocating motion, as herein described.

"I also claim the pivoted rod, and the vibratory lever, which is provided with apertures arranged in the arc of a circle whose centre is at the pivoted end of the rod, in combination with the curved or undulating disk and the guage plate, substantially as herein described, for the purpose of imparting to the gauge plate a reciprocating motion, which may be varied at pleasure by the operator, by inserting the rod in one or another of the apertures in the lever, at different distances from its fulcrum."

Designs for October, 1852.

1. For a *Design for a Cooking Stove;* Charles B. Tuttle, Amherst, New Hampshire, October 5.

Claim.—"What I claim as my invention or production is, the ornamental design for a cooking stove, substantially as represented in the accompanying drawings."

2. For a *Design for a Grate Frame and Summer Piece;* Adam Hampton, New York, October 5.

Claim.—"What I claim therein as new is, the combination and arrangement of the ornamental figures herein represented, the whole forming an ornamental design for a grate frame and summer piece."

3. For a *Design for a Table Frame and Legs;* Walter Bryant, Boston, Massachusetts, October 5.

Claim.—"What I claim as my production is, the new design, consisting of the scroll, vine, and leaf work, herein above described and represented in the drawings, for the side piece, leg, and cross brace of a table."

4. For a *Design for a Grate Frame;* James L. Jackson, City of New York, October 12.

Claim.—"What I claim as new is, the combination and arrangement of the ornamental figures herein represented, the whole forming an ornamental design for a grate frame."

5. For a *Design for a Parlor Stove;* N. S. Vedder, Troy, New York, October 12.

Claim.—"What I claim as new is, the ornamental design and configuration of top and front stove plates, such as is herein described and represented in the annexed drawing."

6. For a *Design for a Cooking Stove;* Elihu Smith, Albany, New York, October 19.

Claim.—"What I claim as my production is, the combination and arrangement of ornamental figures and forms, represented in the accompanying drawings, forming together an ornamental design for a cooking stove."

7. For a *Design for Forks, Spoons, &c.;* Robert Taylor and Robert D. Laurie, Philadelphia, Pennsylvania, October 19.

Claim.—"We do not claim the outline of the spoon, fork, ladle, &c.; but what we do claim is, the design and configuration of the ornaments for spoons, forks, ladles, knives, sugar tongs, &c., above described and set forth in the accompanying drawings."

8. For a *Design for a Cooking Range;* Benjamin Wardwell, Fall River, Massachusetts, and Ephraim R. Barstow, Providence, Rhode Island, October 19.

Claim.—"We claim the design consisting of the combination of the wheat sheaf, running vine, and enclosing fillet or bead, as placed on each of the oven or fire place or chamber doors.

"And we also claim the ornamental design on either of the plates, as described."

9. For a *Design for a Cast Iron Cradle;* Pelatiah M. Hutton, Troy, New York, October 26.

Claim.—"What I claim as my invention is, the design and configuration of the orna-

ments upon the body and upon the sectional parts, combined as in the drawing hereunto annexed, to form an ornamental iron cradle."

10. For a *Design for a Cooking Stove;* James Wager, Volney Richmond, and Harvey Smith, Troy, New York, October 26.

Claim.—"What we claim therein as new is, the above described ornamental design and configuration of the plates as represented."

NOVEMBER.

1. For an *Improvement in Pile Wires and Pincers for Weaving Pile Fabrics;* Erastus B. Bigelow, Clinton, Massachusetts, November 2.

Claim.—"Having pointed out the nature of my invention and its mode of operation, I would remark that I do not wish to confine myself to the precise form of the parts represented; nor do I claim as new constructing them for hand looms; but what I do claim is, making one part of the pile wires which is to be grasped by the pincers, wedged form, or oval shaped, in combination with grooves in the jaws of the pincers to conform thereto, substantially in the manner and for the purpose specified."

2. For an *Improvement in Edge Planes for Shoemakers;* Nicholas Bucher, Weedsport, New Jersey, November 2.

Claim.—"What I claim as my invention is, securing the plane iron, or knife, in a sliding tung, passing through a mortise in the body or handle of the plane, substantially as herein set forth, whereby, with great simplicity of construction, I obtain the facility of adjusting the instrument to the thickness of the sole of the boot or shoe, and of employing the draw cat."

3. For an *Improvement in Sewing Machines;* Christopher Hodgkins, Boston, Massachusetts, November 2.

Claim.—"What I claim as my invention is as follows: I do not herein intend to claim in the mechanism for feeding the cloth, "a notched bar which has a vertical or up and down motion, for fastening the cloth upon, and relieving it from the notches of said bar, by striking it against a yielding plate, and a lateral motion, or motion forwards and back;" but what I do claim as an improvement therein is, the employment of one or more burr wheels, *g*, applied to the carriage, K, and kept continually against the cloth by a spring, (so as to preserve the cloth from falling away from the spring plate or presser over it,) in combination with a spring brake, *k*, operated as described, the whole being combined and made to operate together, substantially as specified.

"And in combination with the presser, G, and the lower needle, I claim a mechanism by which an increase of thickness of the cloth is made the lower needle to the left, the distance required to bring it into correct position, with respect to the upper needle, so as to prevent the said upper needle from passing into the cloth, before passing into the bow of the thread of the lower needle, as set forth.

"And I claim the combination of the slide rod, m^2, the box, n^1, screw, S, slotted arm, r, shaft, *w*, arm, *x*, connecting rod, f^1, slide, a^1, stationary plate, b^1, and cam plate, c^1, as applied to the fulcrum pin, W, of the lever, V, and to the presser, for the purpose of moving the lever, with respect or nearer to the cam, U, for the purpose and in the manner herein described."

4. For an *Improvement in Vibrating Propellers;* Franklin Kellsey, Middletown, Connecticut, November 2.

Claim.—"What I claim as my invention is, the combination in a field or row, of a multiplicity of inclined planes, or sculls, secured by gudgeons on one of the sides thereof, in a frame vibrating horizontally, and the graduation of their propelling velocities, by a similar multiplicity of check pins or stops, so adapted to the respective planes or sculls, that, in vibrating the same, they may propel, as nearly as possible, in equal times, and thereby reduce the propelling principle of the tail of a fish, as nearly as may be, to mechanical purposes, substantially as above described, for the propelling of all kinds or classes of vessels, or boats, by the power of steam, or other power, and with or without sails, as occasion may require."

5. For an *Improvement in Gas Metres;* John Laidlaw, City of New York, November 2.

Claim.—"What I claim as my invention is, the chamber, B, and syphon, M, in combination, in the manner substantially as described, with the pipes, I, J, or other pipe or

pipes, having an opening or openings, similar to J, at the required level of the liquid in the metre, for the purpose of preserving the level and discharging the surplus liquid from the metre."

6. For an *Improvement in Saw Gummers;* J. D. Otstot, Springfield, Ohio, November 2.

Claim.—"Having thus fully described my improved apparatus for gumming saws, what I claim therein as new is, the combination of the frame, shoe, and set screws, in the manner and for the purposes set forth."

7. For *Improved Manufacture of Wire Ferrules;* Wm. T. Richards, New Haven, Connecticut, November 2.

"My improvement consists in manufacturing the wire ferrule, that both ends of it may be smooth, true, and at right angles to its length."

Claim.—"I am aware that wire ferrules have been made, when the coil has been cut directly across the wire; I therefore do not claim the manufacture of wire ferrules, as such, as my invention; but what I claim is, the manufacture of ferrules from iron wire, by cutting them from a helical coil, in such a manner that both ends of each ferrule will be perfectly smooth, true, and square across, at right angles to the length, so that no other finishing of the ends will be needed, to render them fit for use, and so that when soldered, they will be the most convenient and durable ferrules which can be made, when manufactured in the manner substantially as described."

8. For an *Improvement in Seed Planters;* Charles Randall, Palmyra, Georgia, November 2.

"My invention consists in a novel and peculiar arrangement of drill, constructed with particular reference for adapting it to the dropping of cotton seed, but it can be used with nearly equal advantage for a variety of other seed."

Claim.—"Having thus fully described my invention, what I claim as new is, the two disks, combining a hopper, plough, and carrying wheel, substantially as described, in combination with the segment plates, or their equivalents, by which the discharge of seed is regulated, operating substantially as in the manner and for the purpose herein fully set forth."

9. For an *Improvement in Cooking Stoves;* Manly C. Sadler, Brockport, New York, November 2.

Claim.—"What I claim as my invention is, the guard plate for carrying the products of combustion under the oven, that part thereof may pass around and over it to the front, and the rest continue to and up the back flue, substantially as specified, in combination with the recess in the rear of the fire chamber, for extending a portion of the fire near to the oven, and the deflexion plate for dividing the draft and carrying it towards each end of the oven, substantially as and for the purpose specified."

10. For an *Improvement in Seed Planters;* Francis Townsend, Cambria, New York, November 2.

Claim.—"In combination with the regular and positive discharge of seed, by means of the ordinary seed distributor of seed drills, I claim the supplemental or occasional discharge of seed, by a supplemental seed distributor, put in and out of action at the discretion of the operator of the machine, substantially as herein set forth."

11. For an *Improvement in Seed Planters;* Constant S. Trevitt, Ellicottsville, New York, November 2.

Claim.—"What I claim is, the combination of the perforated register plate, the adjusting screw, and the springs arranged and operating as described."

12. For an *Improvement in Seed Planters;* Henry Vermillion, Rising Sun, Maryland, November 2.

Claim.—"Having described my improvement in the distributing apparatus of seed planters, it will be understood that I do not mean to claim the use of a reciprocating gauge plate, having oblique feed openings therein, operating in combination with openings of different obliquity, in the grating plates and bottom of the hopper, for increasing or

diminishing the feed of the seed to be sown, while the machine is in motion, by increasing or diminishing the traverse or sliding movement of the gauge plate; but what I do claim as my invention is, the employment of the pivoted oscillating plate, when made with oblique openings on opposite sides of its centre, reaching to and forming outlets at the circumference of said plate, in combination with segmental or other similar openings above the oblique opening, and a central annular opening in the ring plate, whereby during the oscillation of the pivoted plate, the seed is not only discharged from the outlets of the oblique openings over the circumference of the ring plate, but also through the central annular opening of the ring plate from the centreward ends of the oblique openings."

13. For an *Improvement in Ventilators;* David Wells, Lowell, Massachusetts, November 2.

Claim.—"I do not claim a ventilator made of a series of flat plates, arranged in a circle, with openings between them; nor do I claim one made of a series of plates arranged in a circle or around an axis, and with openings between them, and each made to stand tangential or curved (transversely) to the arc of a circle or curved line of the set of plates: but what I do claim as my invention is, a ventilator constructed of a single series of curved or angular plates and openings, and capped, connected with a tube or flue, and having each plate curved or made angular convexly or concavely, out of the general line of their arrangement, around a common axis, as represented in the drawings."

14. For an *Improved Method of Securing Vault and Safe Doors, &c.;* F. C. Goffin, City of New York, November 2.

"The nature of my invention consists in securing or fastening the doors of safes, bank vaults, &c., &c., by means of movable flanches attached to the door, and arranged as will be hereafter described; said flanches forming a continuous bolt all around between the door and its mouth piece, by which means the door is rendered more secure against fire and force, and less liable to get out of order, than by any other mode of construction."

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, securing or fastening the doors of safes, bank vaults, &c., by means of movable flanches, arranged and attached as herein shown and described, by which means a continuous bolt is formed all around between the door and its mouth piece, preventing the admission of air into the safe, which is thereby rendered secure against fire, and the door against force."

15. For an *Improvement in Mode of Counterbalancing Harnesses in Looms;* James Greenhalgh, Waterford, Massachusetts, November 2.

Claim.—"I do not claim the mere upright position of the jacks, or the mere counterbalancing of the harness; but what I do claim is, the construction of the long double heddles or jacks, in such a manner, and so hanging them on the axle by a short arm, or its equivalent, that in their vibrations neither end of them shall pass beyond a vertical plane passing through the axle on which they rock or oscillate, so that the weight of the jacks shall be thrown outside of their points of suspension; thus counterbalancing the weight of the harness."

16. For an *Improvement in Self-Acting Mules;* Wanton Rouse, Taunton, Massachusetts, November 2.

Claim.—"Having fully described my invention, I will proceed to state what I claim, without confining myself to the precise construction and arrangement of the parts, or to the precise manner of operating them.

"1st, I claim backing off or reversing the spindles. to unwind the yarn from them, and regulating or altering the amount of backing off, as the building of the cops progresses, by means of a step or incline of varying form, extending along a revolving cam or its equivalent, substantially such as is exemplified in the part from 5 to 25, on the cam B, the said step or incline governing the revolution of the spindles.

"2d, I claim the mechanism for making the finger through the irregular surface of the cam B, or its equivalent, acts upon the mechanism which drives the spindles in backing off and building on, to traverse the said cam, or equivalent, and keep it to the surface, consisting of the screws, the nut, the cord or chain, the lever, and stud, operating in combination, in the manner substantially as described."

17. For an *Improvement in Machines for Drilling Stone*; Lemuel P. Jenks, Boston, Assignor to Joseph W. Page, West Roxbury, Assignor to George A. Gardner, Boston, Massachusetts, November 2.

"The nature of my invention consists in providing an arrangement, whereby a reciprocating motion of a drill in combination with a rotation of the said drill is secured, in connexion with a contrivance for feeding forward the said drill into the rock; with this, I have also a contrivance, whereby I can at pleasure graduate the rapidity of the rotation, and also the rapidity of the feeding forward of the same, by either one movement or by two separate movements."

Claim.—"The arrangement of the mandrel head, pawl, and ratchet wheel, as sunken into the cross head, I believe to be an original and valuable improvement; but I do not think it necessary to claim it. The same remark applies to that of the cross cut valve, as applied to steam drills; though since my invention of it, I have learned that a similar arrangement has been applied to pumps. The same remark as to originality and valve, applies to the arrangement of the bars or rods, to effect the turning movements, as swinging on their centres; but I do not feel certain as to their priority, and have not at present the opportunity to ascertain: I therefore do not claim that priority. The side swinging of the frames bearing the drill, is also a new and valuable feature; but I do not think it necessary to claim it.

"But the claim which I do make herein as for my own invention is, the arrangement, (in a swinging or other frame,) for the purpose of drilling rods, of two cross heads, the one with a reciprocating motion, and the other connected therewith and bearing the drill, with a reciprocating and progressively advancing motion, substantially as described; and this, however such alternate advance and recession may be effected.

"I also claim the arrangement of, substantially, a sliding bar, for the purpose of changing both the rate of rotation and the rate of advance of the drill, by one movement, for the purpose and in the manner substantially as described.

"I do not claim the ratchet wheel and pawl holder, operated by the inclined groove, by itself; but I claim the making the ratchet cylinder, or equivalent rotating arrangement, sliding upon the mandrel or drill stock as the same advances, in such manner as that the pawl holder projection retains its place in the inclined groove, substantially as herein described."

18. For an *Improvement in Sewing Machines*; John G Bradeen, Boston, Assignor to himself and George Perkins, Malden, Massachusetts, November 2.

Claim.—"I claim as my improvement the two rotating draft hooks, or their equivalent, separate from the needles, in combination with the two needles and two thread guides, made to be operated together substantially as specified.

"And I claim the improvement of so constructing and operating the needles and thread guides, that each needle, directly after passing into and through the cloth, shall pass through the thread guide which is on that side of the cloth opposite to the side of it in which the needle first enters; meaning to claim the arrangement of each needle and its thread guide, respectively, on opposite sides of the cloth, they being constructed and operated in the manner specified. In F. R. Robinson's machine, they are arranged and made to operate on the same side of the cloth.

"And I also claim the combination of the rocking thread lifter, or its equivalent, with the needle and presser, the said thread lifter being operated as described, by the thread guide lever, or any other proper means."

19. For an *Improvement in Hand Seed Planters*; William Bullock, Philadelphia, Pennsylvania, November 2.

Claim.—"What I claim therein as new and of my invention is, 1st, A seed planter, having a tube or tubes, which, in operating the planter, is or are closed when placed in the ground, and so arranged that it or they can be opened while in the ground, for the purpose of letting the seeds out.

"2d, The arrangement of two or more tubes in such a manner, that the operator can place the seeds in a hill, at specified distances apart.

"3d, The feeders, having a sloping cavity at the outer ends, and being so arranged that as the seeds are carried up, they will slide out and pass into the tubes.

"And, 4th, the arrangement of the feeders and jaws or valves of the tubes, in connexion with the handle, by which the machine is carried, so that the feeder and jaws or valves can be operated by the same hand with which the machine is carried."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

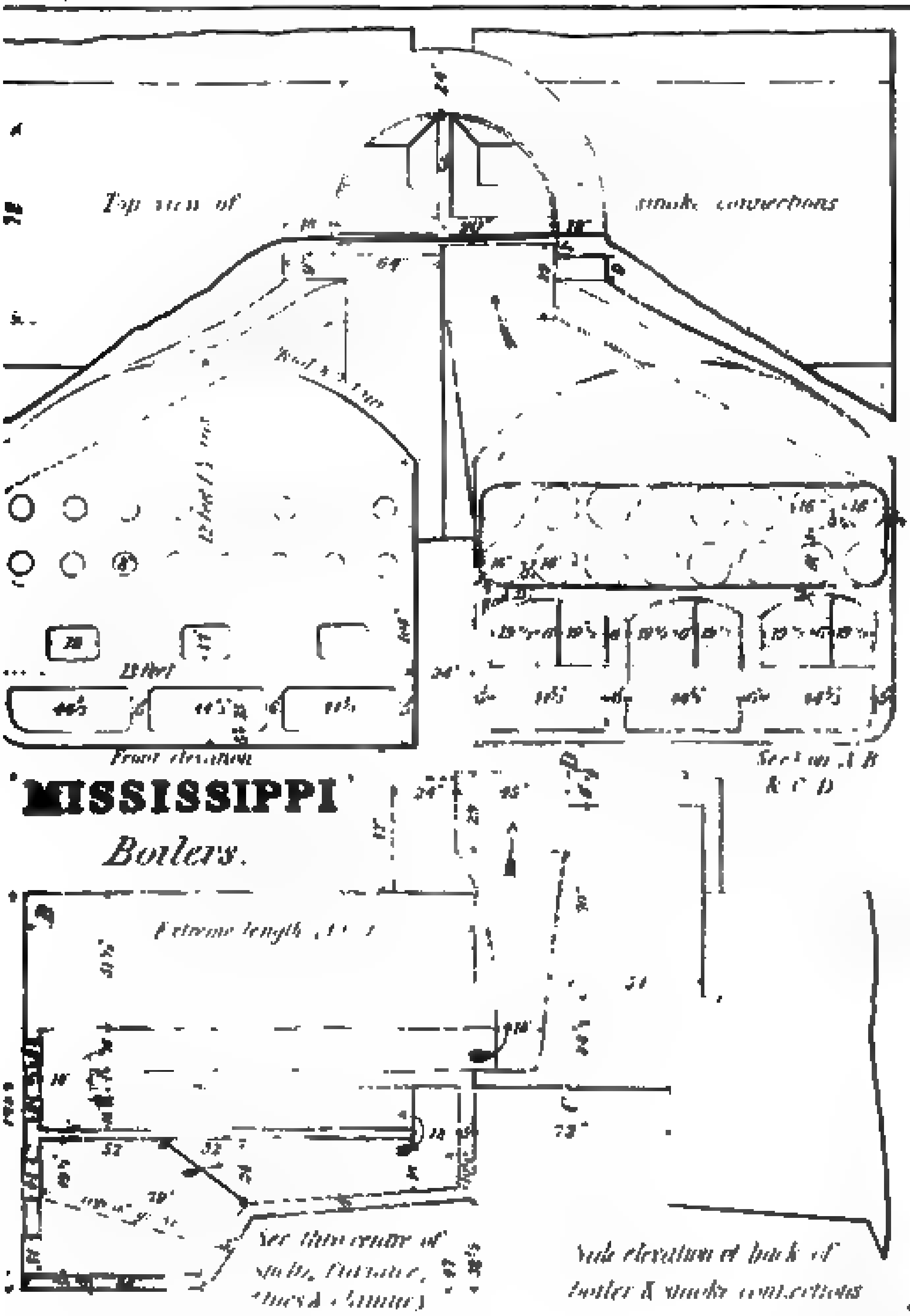
United States Steam Frigate Mississippi. By Chief Engineer B. F. Isherwood, U. S. Navy.

The steam frigate *Mississippi*, built at Philadelphia, and launched May 21, 1841, may be considered as the commencement of the United States steam marine; her sole predecessor, the *Fulton*, being adapted for harbor defence only, and incapable of ocean navigation. The *logs* for the *Mississippi's* entire time of steaming having lately come into my hands, I have prepared carefully from them a summary of her performance, which will be found in tables 1, 2, 3, and 4, hereafter given. These tables embrace all that portion of the vessel's performance where the logs were full, and where the steaming was uninterrupted for such a length of time, with unchanged conditions of weather, sea, throttle, cut-off, steam, &c., as to promise reasonable accuracy for the mean. They of course exclude a considerable amount of steaming for short distances, and where the logs are imperfect and unreliable.

In examining these tables, the reader must bear in mind the manner in which the data was obtained. The speed of the vessel was ascertained by the common chip log, and the result is probably in no case within half a knot of the truth; as a general thing, the speed is over-logged. The double strokes of piston were occasionally obtained from a counter, but generally by counting by the sand glass every quarter hour, and logging the mean—not a very close approximation. The steam pressure was obtained in a similar manner, by taking a mean of quarter hour observations; while the expenditure of coal was taken by *measure*, instead of *weight*—a certain average weight being allowed for each measure; of course, there were inevitable errors here, owing to the measure never being filled twice alike, and also to the fact, that the same measure of larger lumps would weigh less than the same measure of smaller lumps.

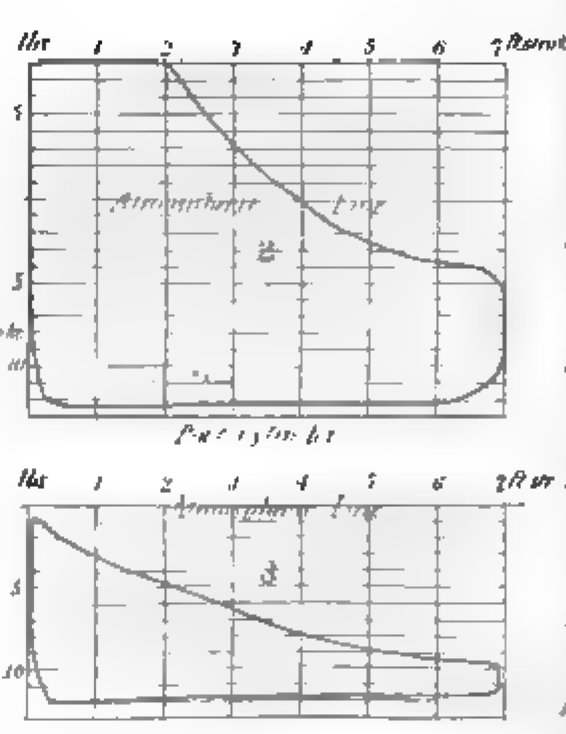
The state of the sea, the direction and kind of wind, &c., recorded in the logs, are very unreliable, as they are judged of entirely according to the fancies and sensations of the observers. What would be called a rough sea by one, would be called a moderate sea by another, and so on. The direction of the wind, as well as its force, is the *apparent* direction and force to an observer on the vessel's deck; where, owing to the progressive movement of the vessel, what appears to be, and is logged as a gentle wind ahead, is in fact a calm, while a calm is a gentle wind aft, and so on. For the same reason, a wind whose direction is logged forward the beam, has its direction abaft the beam.

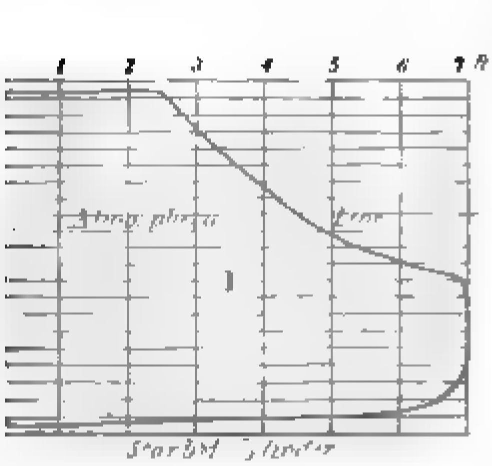
Still, notwithstanding all these errors, the mean of many hours' performance, by the resulting correction of errors thereby obtained, may be depended on as a reasonably close approximation to the truth, sufficiently so for all practical purposes; for the probability is the same, that of a number of observations varying from the truth, as many will be too high as too low; the greater, therefore, the number of observations the nearer will the mean approach the truth. From these considerations, I am per-

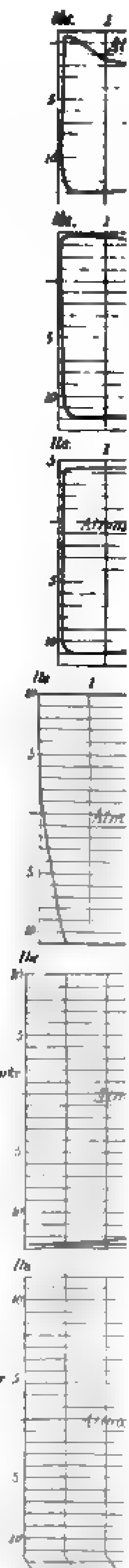


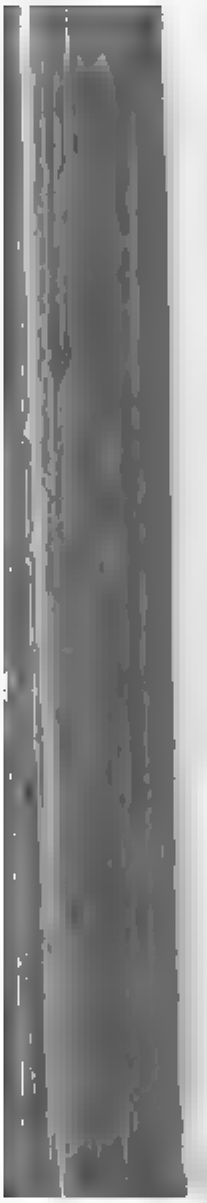
'MISSISSIPPI'
Boilers.

Indicator Diagrams
U.S.S. Mississippi.









suaded that the *means* of tables 1, 2, 3, and 4, may be received and argued upon with confidence. Before, however, discussing their results, it will be useful to give the dimensions of the vessel, machinery, &c., the former of which I have obtained from the constructor.

HULL.—Length over all,	228 feet 9 inches.
Length from aft side of rabbet of post at cross seam to fore side of rabbet of stern at the height of first port-sill,	223 "
Extreme breadth,	40 "
Moulded breadth,	39 "
Height from lower edge of rabbet of keel to first port-sill amidships,	28 "
Depth of hold,	23 " 6 "
Depth of keel and false keel, clear of bottom plank,	2 "
Mean (Constructor's) load draft, *inclusive* of keel, &c., (2 feet,)	20 " 1½ "
Length of mean load line, including both rabbets,	219·71 feet.
Area of immersed amidship section at 20 feet 1½ inch mean draft,	651·3 square feet.
Area of mean load line,	7701 " "

Displacements at the following mean drafts of water, including keel.

Drafts.	Tons of sea water. 2240 lbs. per ton.
12 feet,	1332·16
14 "	1723·68
16 "	2132·81
18 "	2556·52
20 "	2991·80
20 " 1½ inch,	3022·00

Weights of hull and every thing ready for cruising, except machinery and fuel.

	Tons of 2240 lbs.
Hull,	1279·30
Masts, yards, &c.,	52·21
Spare spars,	5·73
Rigging, blocks, and iron work for rigging,	30.13
Sails and awnings,	10·22
Cables, anchors, and appurtenances,	63·66
Nine boats, with oars,	10·47
Armament, (gun carriages, pivots, breachings, &c., for two 10-inch and four 8-inch guns,)	32·90
Cases for powder,	5·24
Powder,	2·02
Shell and shot boxes,	1·11
Forty solid 8-inch shot,	1·25
Tanks, casks, kids, cans, &c.,	19·02
15,092 gallons of water at 8·34 pounds,	56·20
Provisions for 200 men for four months,	43·50
226 men, with baggage, at 225 pounds, (no engineer or fireman,)	22·70
Fuel for galley,	21·60
Galley and fixtures,	4·70
Furniture for cabin, ward room, &c.,	2·73
Master's stores,	1·80
Carpenter's "	5·83
Gunner's "	4.02
Boatswain's "	8·95
Surgeon's, Purser's, and Officer's stores,	3·52
Engineer's stores,	8·34
Engineers and Firemen,	4·42
Total,	1701·57

RIG.—The *Mississippi* is barque-rigged, and spreads 19,030 square feet of canvass in the nine principal sails.

Engines.—Two side lever engines, with cast iron frames, and balance puppet steam and exhaust valves. The steam valve is used with Stevens' arrangement, as a cut-off valve.

Diameter of cylinders,	75 inches.
Stroke of piston,	7 feet.
Space displacement of both pistons per stroke,	429·5 cubic feet.
Diameters of the disks of the steam and exhaust valves,	13¾ and 14¾ inches.
Area of steam and also area for exhaust through the valves, each,	319·362 square "
Diameter of air pump,	46½ inches.
Stroke of air pump piston,	3 feet 8 "
Space displacement of both pistons of air pumps per stroke,	86·5 cubic feet.
Capacity of condensers,	150 " "
Diameter of main shaft,	17 inches.
Steam space between cut-off valves and pistons, one end of both cylinders,	21·52 cubic feet.
Length occupied by engines alone,	31 feet.

Weight of Engines complete.

Cast iron,	430,769 pounds.
Wrought iron,	250,582 "
Wrought copper,	16,496 "
Wrought steel,	1,138 "
Brass castings,	35,470 "
Total,	734,455 "

Paddle Wheels.—Diameter from outside to outside of rings, 30 feet.

Number of paddles in each wheel,	21.
Length of each paddle,	11 feet.
Width " "	30 inches

Weight of Paddle Wheels complete.

Cast iron,	16,579 pounds.
Wrought iron,	29,368 "
Oak paddles,	14,448 "
Total,	60,395 "

Boilers.—(Plate III.)

Four copper boilers, with double return ascending flues. The boilers are placed in pairs, back to back, with one smoke chimney in common.

Length of each boiler, including its smoke connexions,	16 feet 9 inches.
Breadth " "	13 "
Height " " exclusive of steam chimney,	12 " 1½ "
Solidity of the circumscribing parallelopipedon of each boiler,	2640·22 cubic feet.
Area of the total heating surface in the four boilers,	5400 square "
" " grate " " "	268 " "
Aggregate cross area of lower arches at bridge in the four boilers,	72·026 " "
" " " " " at back end of boiler "	52·693 " "
" " " of middle row of flues in the four boilers,	44·68 " "
" " " of upper " " " "	44·68 " "
Cross area of the smoke chimney,	44·18 " "
Height of smoke chimney above the grates,	65 feet.
Capacity of steam room in the four boilers and steam chimney,	1770 cubic feet.
" " " " " steam chimney, and steam pipes,	1876 " "

Proportions.—Proportion of heating to grate surface, 20·149 to 1·000

Proportion of grate surface to aggregate cross area of lower arches at bridge,	3·721 "
" " " " of lower arches at back of boiler,	5·086 "
" " " " of middle row of flues,	6·000 "
" " " " of upper " "	6·000 "
" " " " of smoke chimney,	5.066 "
Square feet of heating surface per cubic foot of space displacement of pistons per stroke,	12·572.
Square feet of grate surface per cubic foot of space displacement of pistons per stroke,	0·544.

Weights.

Brass castings,	16,182	pounds.
Iron castings, exclusive of grate bars,	2,427	"
Grate bars, (165 pairs and 12 single bars,)	22,079	"
Wrought iron, exclusive of smoke chimney,	17,509	"
Iron smoke chimney,	11,468	"
Wrought copper,	681	"
Four copper boilers and steam chimney, including braces and rivets only, not other appurtenances,	227,811	"
Total weight of boilers and appurtenances,	298,157	"
Weight of sea water in the four boilers,	183,680	"
The coal bunkers weigh	38,276	"
And contain of bituminous coal,	550	tons.

Cost of the Mississippi.

Cost of labor, all inclusive except machinery,	$129,344
" materials,	175,020
" machinery, except boilers,	167,583
" boilers,	81,901
Total cost of vessel,	$553,848

In the construction of the engines there was employed labor 16,658¼ days, at the average rate of $2·25 per day. Labor on patterns, 2302¾ days.

Repairs on the Hull of the Mississippi.

Cost of repairs done in 1845,	$10,300
" " 1847,	8,740
" " 1848,	3,630
" " 1849,	66,060

Repairs on the Machinery of the Mississippi.

Cost of repairs done in 1845,	$17,841
" " 1847,	2,855
" " 1848,	1,335
" " 1849,	61,967
" " 1852,	72,952

The total length in the vessel occupied by engines, boilers, coal bunkers, paddle wheels, and fire and engine rooms, is 113 feet.

PERFORMANCE OF THE MISSISSIPPI.

The performance of the *Mississippi* has been divided into four parts, and a summary of each given in tables 1, 2, 3, and 4. Tables 1 and 2 comprise the steaming done on the coast of the United States, in the Atlantic Ocean, and in the Gulf of Mexico; with the diameter of the paddle wheels 28 feet from outside to outside of paddles, and burning the Cumberland bituminous coal. In table 1 is given the performance under steam alone; in table 2 is given the performance under steam and sail.

Tables 3 and 4 comprise the steaming done in the Mediterranean and in crossing the Atlantic, from June 8th to June 12th, 1849, making 24 hours in table 3, and 60 hours in table 4. The paddle wheels were 28 feet diameter from outside to outside of paddles, and for the remainder of the performance contained in these tables it was 29 feet from outside to outside of paddles.

TABLE I.—Performance of the Mississippi under steam alone in the Atlantic Ocean and Gulf of Mexico, between October 24, 1845, and March 13, 1847.

Date.		Number of hours.	Speed of vessel in knots of 6082⅔ feet per hour.	Wind. Direction.	Wind. Kind.	State of the sea.	Engines. Double strokes of piston per minute.	Engines. Steam pressure in boiler above atmosphere in pounds per sq. inch.	Engines. Steam cut off at, from commencement of st'k of piston, in inches.	Engines. Throttle open.	Engines. Vacuum in condenser in in. of mer'y pr. gauge.	Pounds of coal consumed per hour.	Immersion of lower edge of paddles, in feet and inches.	Hull. Mean draft in feet and inches.	Hull. Area of immersed amidship section, in sq. ft.	Hull. Displacement of sea water, in tons of 2240 pounds.
Oct. 24 to Oct. 26,	1845	72	6·867	Ahead.	Fresh wind.	Rough.	11·300	12·0	38	⅜	26½	3963	5 11	18 9	596·3	2718·9
Oct. 27 to Oct. 28,	"	36	7·940	"	Light airs.	Moderate.	13·100	12·9	"	Wide.	"	1824	5 8	18 6	586·3	2663·8
March 24 and 25,	1846	34	7·212	On bow.	Fresh breeze.	"	9·912	10·9	26	"	27½	2666	7 0	19 8	633·0	2920·0
March 27 and 28,	"	23	7·335	Abeam.	Light breeze.	Smooth.	10·522	11·6	"	¼	"	2633	6 9	19 5	623·0	2865·9
March 31 to April 3,	"	84	7·743	Ahead.	Gentle breeze.	"	12·800	13·0	34	Wide	"	4226	5 8	18 6	586·3	2663·8
May 5 to May 9,	"	114	6·905	"	" "	Moderate.	10·214	10·4	36	"	"	3072	6 4	19 0	606·3	2774·0
May 10 to May 17,	"	48	7·077	Abeam.	Moderate "	"	10·848	9·4	32	¾	"	2652	6 7	19 3	616·3	2829·1
June 1 to June 3,	"	58	6·984	"	Gentle "	Smooth.	9·207	14·2	26	Wide.	"	2378	7 0	19 8	633·0	2921·0
June 20 and 21,	"	28	6·250	Ahead.	" "	"	9·000	9·5	34	"	"	2500	6 10	19 6	626·3	2884·2
June 27 to July 1,	"	44	6·750	Abeam.	" "	"	10·273	12·6	"	"	"	3120	5 9	18 7	589·6	2691·7
October 4 and 5,	"	48	7·250	Variable.	Light airs.	"	10·850	11·9	32	"	"	2727	6 10	19 6	626·3	2884·2
November 18 and 19,	"	30	7·333	Abeam.	Fresh breeze.	Rough.	10·567	11·8	35	"	"	3102	6 10	19 6	626·3	2884·2
Nov. 24 to Nov. 28,	"	100	4·708	On bow	Moderate gale.	Heavy ahead.	8·114	7·9	37	¾	"	2172	5 10	18 8	593·0	2700·5
Dec. 26, '46, to Jan. 12,	'47	204	6·396	"	Strong wind.	" "	11·071	9·8	"	"	"	3072	5 8	18 6	586·3	2663·8
March 8 to March 15,	"	152	6·746	"	Moderate "	Moderate "	9·000	10·5	32	Wide.	"	3229	6 8	19 4	619·6	2817·5
Oct. 21 to March 13,	"	107	7·724	"	Gentle breeze.	Smooth.	11·289	11·9	39	¾	"	2063	5 10	18 8	593·0	2700·5
Means,			6·968				10·480	11·0	35	⅞	27½	3003	5 11	18 9	596·3	2718·9

TABLE II.—PERFORMANCE OF THE MISSISSIPPI UNDER STEAM AND SAILS SET TO TOPSAILS, IN THE ATLANTIC OCEAN AND GULF OF MEXICO, BETWEEN MARCH 26, 1846, AND OCTOBER 20, 1847.

DATE.		Number of hours.	Speed of vessel in knots of 6082⅔ feet per hour.	WIND. Direction.	WIND. Kind.	State of the sea.	ENGINES. Double strokes of piston per minute.	ENGINES. Steam pressure in boiler above atmosphere in pounds per sq. inch.	ENGINES. Steam cut off at, from commencement of st'k of piston, in inches.	ENGINES. Throttle open.	ENGINES. Vacuum in condenser in in. of mer'y pr. gauge.	Pounds of coal consumed per hour.	Immersion of lower edge of paddles, in feet and inches.		HULL. Mean draft in feet and inches.		HULL. Area of immersed amidship section, in sq. ft.	HULL. Displacement of sea water in tons of 2240 pounds.
March 26 and 27,	1846	35	8·030	Abeam.	Moderate.	Moderate.	10·812	11·0	26	Wide.	27½	2658	6	10	19	6	626·3	2884·2
May 10 to May 12,	"	27	6·975	"	Gentle.	"	10·268	6·3	36	½	"	2329	6	10	19	6	626·3	2884·2
May 15 and 16,	"	25	7·040	Abaft the beam	Moderate.	"	9·660	6·4	28	3-16	"	1702	6	2	18	10	599·7	2737·2
May 31 and June 1,	"	25	7·380	Abeam.	"	Rough.	10·844	13·3	30	Wide.	"	3414	7	0	19	8	633·0	2921·0
June 21 to June 24,	"	80	6·341	Abaft the beam	"	Smooth.	8·130	5·6	24	3-16	"	800	7	0	19	8	633·0	2921·0
June 29,	"	12	8·500	Abeam.	"	"	11·100	11·1	33	Wide.	"	3540	5	11	18	7	589·6	2681·7
July 1,	"	10	8·300	"	"	"	12·300	12·7	33	"	"	2200	5	10	18	6	586·3	2663·8
October 1 to October 3,	"	67	7·436	Abaft the beam	"	"	10·494	11·3	32	"	"	2422	7	2	19	10	639·7	2957·4
Nov. 15 to Nov. 24,	"	40	8·020	For'd the beam	Fresh.	Rough.	11·110	9·7	35	"	"	2880	6	10	19	6	626·3	2884·2
December 3,	"	20	8·000	Aft.	Moderate.	Smooth.	12·500	11·1	33	"	"	3929	7	0	19	8	633·0	2921·0
Dec. 26 to Dec. 31,	"	27	7·022	Abeam.	"	Moderate.	9·945	7·3	34	¼	"	2395	6	7	19	3	616·3	2829·1
January 10 and 11,	1847	28	8·871	"	"	Rough.	13·107	10·2	26	Wide.	"	3134	6	7	19	3	616·3	2829·1
March 14,	"	14	7·145	Abaft the beam	Light.	Smooth.	9·000	8·0	26	3-16	"	1300	6	2	18	10	599·7	2737·2
Oct. 18 to Oct. 20,	"	72	7·750	" "	Moderate.	"	9·767	9·4	36	Wide.	"	2647	7	7	20	3	656·3	3049·6
March 16 to March 18,	"	48	8·210	Aft.	Fresh.	"	8·900	7·7	30	1-32	"	1721	6	2	18	10	599·7	2737·2
March 19.	"	12	9·500	"	"	"	12·500	8·3	30	¾	"	3120	6	0	18	8	593·0	2700·5
Means,			7·574				10·174	9·0	30	11-16	27½	2305	6	10	19	6	626·3	2884·2

TABLE III.—PERFORMANCE OF THE MISSISSIPPI UNDER STEAM ALONE IN THE ATLANTIC AND MEDITERRANEAN, BETWEEN JUNE, 1849, AND NOVEMBER, 1851.

DATE.		Number of hours.	Speed of vessel in knots of 6082⅔ feet per hour.	WIND. Direction.	WIND. Kind.	State of the sea.	ENGINES. Double strokes of piston per minute.	ENGINES. Steam pressure in boiler above atmosphere in pounds per sq. inch.	ENGINES. Steam cut off at, from commencement of st'k of piston, in inches.	ENGINES. Throttle open.	ENGINES. Vacuum in condenser in in. of mer'y pr. gauge.	Pounds of coal consumed per hour.	Immersion of lower edge of paddles in feet and inches.	HULL. Mean draft in feet and inches.	HULL. Area of immersed amidship section in sq. ft.	HULL. Displacement of sea water in tons of 2240 pounds.
June 6,	1849	12	7·750	Abeam.	Moderate.	Smooth.	8·667	7·6	35	Wide.	27½	2254	7 11	20 7	669·7	3123·0
June 10,	"	12	8·167	Ahead.	Gentle.	"	9·825	10·5	33	"	"	2361	7 8	19 10	639·7	2957·4
June 18 to June 27,	"	176	8·500	On bow.	"	"	11·860	9·4	33	"	"	2722	5 8	17 10	559·7	2517·1
July 9 to Oct. 23,	"	252	7·405	"	"	"	10·621	10·5	30	"	"	2611	6 10	19 0	606·3	2774·0
Feb. 17 to June 3,	1850	108	7·120	"	"	"	10·760	10·7	20	"	"	2464	6 10	19 0	606·3	2774·0
June 17 and 18,	"	23	7·609	"	Light.	"	10·891	11·1	40	"	"	3068	6 11	19 1	609·6	2794·4
July 28 to Nov. 6,	"	92	7·044	"	"	"	10·206	10·3	28	"	"	2500	6 7	18 9	596·6	2718·9
Feb. 25 to April 13,	1851	48	8·063	Ahead.	Gentle.	"	11·750	11·3	25	"	"	3498	6 2	18 4	579·6	2627·1
April 19 to May 14,	"	160	7·913	"	Light.	"	10·188	10·4	29	"	"	2815	6 4	18 6	586·3	2663·8
May 23 to July 2,	"	232	7·614	On bow.	"	"	11·150	10·1	30	"	"	2816	6 10	19 0	606·3	2774·0
July 8 and 16,	"	36	7·611	Abaft beam.	Gentle.	"	11·444	10·6	32	"	"	3024	5 10	18 0	566·3	2553·9
July 21 to August 20,	"	149	7·846	Forward beam.	Light.	"	10·886	8·3	26	"	"	2645	6 4	18 6	586·3	2663·8
Aug. 29 to Oct. 5,	"	270	7·944	On bow.	Gentle.	"	10·083	9·2	24	"	"	2605	6 8	18 10	599·7	2737·2
October 16 and 17,	"	40	7·550	"	Moderate.	"	9·300	9·8	26	"	"	2460	7 10	20 0	646·3	2994·4
Oct. 19 to Oct. 23,	"	90	6·722	Ahead.	Gentle.	"	8·572	9·1	26	"	"	2290	7 10	20 0	646·3	2994·4
November 1,	"	24	7·500	"	Light.	"	10·509	10·2	26	"	"	2480	6 2	18 4	579·6	2627·1
November 5,	"	24	6·917	On bow.	Moderate.	"	10·317	10·2	27	"	"	3135	5 6	17 8	553·0	2480·4
Means,			7·675	On bow.	Gentle.	Smooth.	10·623	9·8	28	Wide.	27½	2561	6 7	18 9½	598·0	2729·1

TABLE IV.—Performance of the Mississippi under steam and sail set to Topsails, in the Atlantic and Mediterranean, between June, 1849, and November, 1851.

Date.		Number of hours.	Speed of vessel in knots of 6082⅔ feet per hour.	Wind. Direction.	Wind. Kind.	State of the sea.	Engines. Double strokes of piston per minute.	Engines. Steam pressure in boiler above atmosphere in lbs. per sq. in. per gauge.	Engines. Steam cut off at, from commencement of st'k of piston in inches.	Engines. Throttle open.	Engines. Vacuum in condenser in. in. of mer'y per gauge	Pounds of coal consumed per hour.	Immersion of lower edge of paddles in feet and inches.		Hull. Mean draft in feet and inches.		Hull. Area of immersed amidship section in sq. ft.	Hull. Displacement of sea water in tons of 2240 pounds.
June 8 and 9,	1849	36	8·017		Moderate.	Moderate.	9·444	9·1	34½	Wide.	27½	2443	7	10	20	6	666·3	3104·7
June 11 and 12,	"	24	8·750	Abeam.	Strong.	Smooth.	9·541	10·7	33	"	"	2371	7	7	20	3	656·3	3049·6
June 26,	1851	8	7·000	Aft.	Moderate.	"	10·450	8·5	30	"	"	2520	6	11	19	1	609·6	2794·4
July 19,	"	24	9·166	Abeam.	"	"	12·604	7·7	36	"	"	3024	5	5	17	7	549·6	2461·2
July 20,	"	24	8·833	On quarter.	Strong.	Moderate.	11·804	7·7	36	"	"	3024	5	3	17	5	543·0	2424·6
August 21,	"	12	8·583	Abeam.	Light.	Smooth.	10·192	9·4	24	"	"	2520	6	0	18	2	573·0	2590·3
October 18,	"	24	9·000	Forward beam.	Strong gale.	Moderate.	10·150	9·1	26	½	"	2261	7	10	20	0	646·3	2994·4
October 26 and 27,	"	48	8·250	Aft.	"	"	11·208	9·0	26	Wide.	"	1925	6	11	19	1	609·6	2794·4
October 28 and 29,	"	48	7·000	Forward beam.	Strong.	"	8 277	9·1	26	⅛	"	1570	6	10	19	0	606·3	2774·0
Nov. 2 to Nov. 4,	"	60	8·117	"	"	Smooth.	11·233	10·4	24	Wide.	"	2698	5	9	17	1	563·0	2535·2
Nov. 6 to Nov. 9,	"	82	8·573	"	"	"	12·452	9·5	25	"	"	3144	5	3	17	5	543·0	2424·6
Means,			8·302	Strong.	Strong.	Smooth.	10·858	9·4	28	Wide.	27½	2518	6	4	18	7	589·6	2681·7

In the following comparative summary of the vessel's performance, the evaporation obtained from the fuels has been calculated, using Regnault's tables of the latent heat of steam. The initial pressure in the cylinder was obtained from a collacation of many indicator diagrams. The temperature of the feed water entering the boilers is taken at 100° F., the usual average for condensing engines; and the loss by *blowing off* necessary to prevent the deposition of scale, was calculated on the supposition that the sea water was carried at double the natural concentration, or at $\frac{2}{32}$ of the Sewell salinometer used in the Navy, which is the average concentration. The horses power developed by the engines has been calculated from indicator diagrams.

Comparative Summary of the Performance of the Mississippi, deduced from the Means of Tables I, II, III, & IV.

	Table I.	Table II.	Table III.	Table IV.
	Steam alone.	Steam and sails.	Steam alone.	Steam and sails.
OBSERVED.				
Number of hours performance,	1248	542	1749	390
Speed of vessel per hour in knots of 6082⅔ feet,	6·868	7·574	7·675	6·302
Double strokes of piston made per minute,	10·486	10·174	10·623	10·858
Steam pressure in boilers above atmosphere in pounds per square inch, ...	11·0	9·0	9·8	9·4
Steam pressure in cylinders above atmosphere in pounds per square inch, . .	9·5	7·2	8·3	7·9
Steam cut off at, from commencement of stroke of piston in inches, ...	35·	30·	28·	28·
Throttle open, ...	⅞	11-16	Wide.	Wide.
Vacuum in condenser, in inches of mercury,	27½	27½	27½	27½
Pounds of coal consumed per hour, .	3093	2305	2561	2518
Immersion of lower edge of paddles in ft. and in.,	5 11	6 10	6 7	6 4
Mean draft of vessel in feet and inches,	18 9	19 6	18 9½	18 7
Area of immersed amidship section in sq. feet,	596·3	626·3	598·0	589·6
Displacement of sea water in tons of 2240 lbs.,	2718·9	2884·2	2728·1	2681·7
CALCULATED.				
Mean effective pressure on pistons in pounds per square inch, ...	17·70	14·00	15·00	14·75
Horses power developed by the engines, .	695·73	533·92	597·30	600·34
Slip of the centre of pressure of the paddles in per cents. of their speed, . .	20·00	9·07	14·82	9·87
Oblique action of the paddles calculated as the squares of the sines of their angles of incidence on the water in per cents, .	21·65	25·68	21·64	21·60
Pounds of steam evaporated by one pound of coal from sea water of twice the natural concentration, with temperature of feed water, 100° F., including loss by *blowing off* to keep the sea water at twice the natural concentration, ...	5·363	5·533	5·133	5·246

An examination of this comparative summary shows in a striking manner the influence of *weather* on the performance of a paddle wheel steamer. Comparing the mean of the results from tables 1 and 3, the vessel being under steam alone, we find the draft of water the same, and consequently the resistance of the hull the same; but in table 1, the engines exerted 695·73 horses power, while in table 3 they exerted only 597·30 horses

power, or 14·15 per centum less, the speed of the vessel in the latter case being greater than in the former case by 0·807 knots, or 11·75 per cent. As a reduced slip of the paddles, necessarily resulting from their deeper immersion in table 3, would to a great extent be balanced by an increased loss of effect from their increased oblique action, the efficiency of the paddle wheels in the two cases may be taken at about the same. The friction of the engines may also be considered about equal, as the number of double strokes of piston were nearly the same per minute.

A recurrence to tables 1 and 3 will show the steaming to have been performed in table 1, both in winter and summer, with strong head winds and rough seas, as an average for half the time; while in table 3, the steaming was performed wholly in the summer, with smooth seas, and but gentle breezes ahead—a difference of weather fully sufficient to cause the difference of speed.

Tables 2 and 4 give the performance of the vessel under steam and sail, during the same periods of time for which tables 1 and 3 give it under steam alone. In the case of table 2, the vessel's draft of water was one foot greater than in the case of table 4; while in the latter instance the horses power developed by the engines was 12·44 per cent. greater than in table 2, but the speed was also greater by 0·728 knots, or 9·61 per cent.

The difference of slip in tables 1 and 2 is 10·93 per cent., and in tables 3 and 4 is 5·95 per cent. The greater difference in the first than in the second case is easily accounted for by referring to the tables, where it will be seen that the wind was much stronger in table 2 than in table 4; also, that the paddles had the greatest immersion.

As has been before stated, tables 2 and 4, giving the performance under steam and sail, show a greater speed than tables 1 and 3, giving the performance under steam alone. These differences are respectively 0·706 knot and 0·627 knot, or an increase of speed of 10·28 and 8·17 per cent. The sails, however, assisted but in a trifling manner in the production of this effect, which is owing almost entirely to the fact of the power of the wind being removed from acting against the vessel, ahead, and either applied abaft the beam, to assist her progress, thus counting twice, by deduction and addition, or being applied abeam, producing a negative effect, and counting only by deduction.

Evaporation by the Boilers.

A reference to the comparative summary shows that the boilers of the *Mississippi* evaporated sensibly the same weight of steam for the same weight of coal, in the performances given in all four tables; the discrepancy being only 0·17 pound of steam, in a mean evaporation of 5·498 pounds of steam per pound of coal, during the performances given in tables 1 and 2; and 0·113 pound of steam per pound of coal, during the performances given in tables 3 and 4, in a mean evaporation of 5·19 pounds of steam per pound of coal. The mean evaporation in all four tables is 5·319 pounds of steam per pound of coal, from which result the maximum differs but 3·86 per cent., and the minimum 5·38 per cent., an amount quite within the ordinary errors of observation. We are, therefore, entitled to conclude that in the boilers of the *Mississippi*, one

pound of Cumberland bituminous coal, which was the kind used during the steaming in tables 1 and 2, produced the same evaporation as one pound of British bituminous coal, which was the kind used during the steaming in tables 3 and 4; consequently, the steam generating qualities of the two coals were equal. This conclusion is also warranted by the similar chemical constitutions of the two coals, which are as follows, on the authority of Prof. W. R. Johnson, for the Cumberland, and the British Admiralty Commission of Playfair and De la Beche, for the British coals:

	Cumberland Bituminous. Average of 5 kinds.	British Bituminous. Average of 6 kinds.
Carbon,	75·05	75·21
Volatile matter,	14·20	14·60
Sulphur,	....	1·39
Ash,	9·49	8·80
Moisture,	1·25	....
	99.99	100·00

INDICATOR DIAGRAMS.—(PLATE III.)

Indicator diagrams Nos. 1 and 2, show about the average performance, corresponding to tables 3 and 4.

Diagram No. 7, shows the similar performance, corresponding to table 1.

Diagrams Nos. 3, 4, 5, and 6, are given to show the effect of *throttling.* They were taken on the passage from Smyrna to Constantinople, February 22, 1850.

When No. 3 was taken, the throttle was *close shut;* steam pressure in boilers 6 pounds per square inch above atmosphere; double strokes of piston per minute, 6.

When No. 4 was taken, the throttle was *one-eighth* open; steam pressure in boilers, 5½ pounds per square inch above atmosphere; double strokes of piston per minute, 7.

When No. 5 was taken, the throttle was *one-quarter* open; steam pressure in boilers, 6 pounds per square inch above atmosphere; double strokes of piston per minute, 8½.

When No. 6 was taken, the throttle was *three-eighths* open; steam pressure in boilers, 6 pounds per square inch above atmosphere; double strokes of piston per minute, 9.

Diagrams were continuously taken up to a wide throttle; but after three-eighths open, no further difference was discernible between the boiler and cylinder initial pressures; showing that about half the area of steam valve used was sufficient to pass all the steam required for working the engines at the usual speeds of piston.

Diagrams 8 and 9 are from the *air pumps.* When they were taken, (June 14, 1851,) the vessel was drawing 18 feet 8 inches forward, and 18 feet 5 inches aft. Speed of vessel, 8½ knots per hour; light wind ahead, and smooth sea; steam pressure in boilers, 12½ pounds per square inch above atmosphere; double strokes of piston per minute, 12; vacuum in condenser, 27½ inches of mercury; steam cut off in cylinder at 28 inches from commencement of stroke; initial steam pressure in cylinders, 11 pounds per square inch above atmosphere.

Simultaneously with the air pump diagrams, diagrams were taken from the steam cylinders, and gave a mean effective pressure throughout the stroke of 16·9 pounds per square inch of piston. The mean effective pressure throughout the stroke of the air pump pistons was 5·4 pounds per square inch. The space displacement of both steam cylinder pistons being 429·5 cubic feet, and of both air pump pistons 86·5 cubic feet, and the air pump pistons making but one delivering stroke to each double stroke of the steam pistons, the power required to work the air pump will be $\left(\frac{86·5}{429·5} \div 2 = 0·1014\text{, and } 0·1014 \text{ of } 5·4 =\right)$ 0·533 pound per square inch of steam cylinder piston; to this must be added the weight of water lifted by the pump, which by the diagrams appear to have filled about one-ninth the capacity of the pump, or to have been $\left(\frac{86·5}{9} =\right)$ 9·61 cubic feet, which multiplied by 64·3 pounds, the weight of a cubic foot of sea water, and divided by 3396·4 square inches, the areas of both pumps, give 0·182 pounds per square inch of air pump piston; reducing this in the same proportion as above for the pistons of the steam cylinders, it becomes 0·018 pound per square inch, which added to the previous 0·533 pound, makes the power absorbed in working the air pumps of the *Mississippi* to be 0·551 pound per square inch of the steam cylinder pistons. This is of course exclusive of the friction of the pumps, an amount which can only be estimated.

Translated for the Journal of the Franklin Institute.

Method of Obtaining Positive Direct Impressions upon Glass. By M. Adolphe Martin.

The simplicity of the employment of the iodized collodion as a sensitive coating, the rapidity with which it receives the luminous impressions, and the delicacy of the picture obtained, have turned all minds towards its exclusive employment. The methods which have been heretofore given refer especially to the obtaining negative pictures, and notwithstanding the remarkable results which have been reached, we cannot but remark the want of harmony and relief of the proofs obtained by these methods.

As I have been employed for some time in this matter, I will soon communicate to the Academy some ameliorations which I have discovered; in the mean time, I think that I shall be rendering a service to photography by communicating a process for obtaining direct positive pictures, as sure as it is easy.

The collodion as I employ it, is composed of an ethereal solution of gun-cotton, (made by heating 2 grammes of pure cotton by 50 grammes of nitrate of potassa and 100 grammes of sulphuric acid; the cotton well washed and well dried is then entirely soluble in a mixture of 10 volumes of ether and 1 volume alcohol;) ether and alcohol are then added, so that the solution is composed of 1 gramme of cotton, 120 grammes ether, and 60 grammes alcohol; there is then added about 1 gramme of nitrate of silver, transformed into iodide and dissolved in 20 grammes alcohol, by means of an alkaline iodide, but iodide of ammonium is preferable.

The plate of glass covered in the ordinary way with a thin coating of this solution, is, before it is dry, plunged into a bath composed of 1 part of distilled water, $\frac{1}{12}$th nitrate of silver, and $\frac{1}{26}$th nitric acid. It is placed in the camera as usual for some seconds. The glass plate is then plunged into a bath of sulphate of protoxide of iron, and then washed with care.

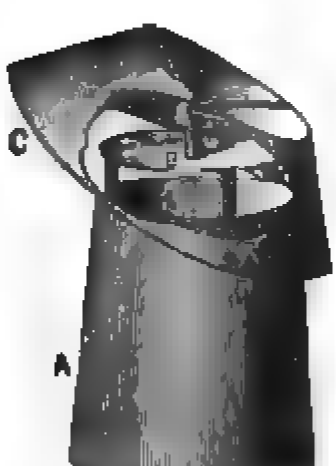
Up to this time the image remains negative; but by plunging it in a bath of the double cyanide of silver and potassium, it becomes positive and complete, if its exposure to the light has been properly managed. There is nothing more to be done than to wash it, coat it with dextrine, and dry it, then frame it in a ground of black velvet.

The bath of cyanides which I use, is the same as that of MM. Ruolz and Elkinton; it is only diluted with about three volumes of water. It is composed of 1 litre of water, 25 grammes cyanide of potassium, and 4 grammes nitrate of silver.

I would remark, in conclusion, that this process always gives me pictures, and that the pictures are always positive. Their perfection only depends on the proper appreciation of the time of exposure.

Ventilating Wind-Guard. Registered for M. A. Suter, *Fenchurch Street, London.**

Our illustration of this last new form of wind-guard so clearly explains its construction, as to render our description almost unnecessary. The barrel, A, terminating the flue, has attached, at a short distance above its open upper end, a flat disk, B, so as to leave an annular discharge aperture for the smoke. In the centre of this disk is a short stud, carrying a universal joint on its top, for the purpose of supporting an adjustable open-topped deflector, or saucer-shaped shield, C, part of which is here broken away to show the joint inside. The figure shows its behavior under the action of a side wind, when it affords a very good shield for the windward side, and a very clear smoke passage on the lee. A great point in this contrivance is the arrangement of the centre joint, which allows the shield to turn with the least breath of wind, and thus afford a constant screen.



Translated for the Journal of the Franklin Institute.

Oxygen from Melted Silver. Extract of a Letter from M. Levol *to* M. Dumas.

As was first observed by Samuel Lucas, pure silver melted in contact with the air absorbs oxygen from it rapidly, and this oxygen is completely disengaged at the moment that the silver becomes solid again. If you desire to extract it during the time that the metal remains fused, you

* From the London Practical Mechanic's Journal, September, 1852.

may do so by means of carbon, which withdraws it by forming carbonic acid; but to separate it in its natural condition appears difficult—nevertheless, it can be accomplished by adding gold in proportion; and in a moment the oxygen is seen to discharge itself so rapidly and so tumultuously as to result in a true effervescence; the matter boils, and rises above the edges of the crucible, even if it be of three or four times the bulk of the melted metals.

Independent of the instruction furnished by this experiment, it furnishes a very curious experiment, and one which a public audience may easily be made to witness.—*Comptes Rendus de l'Academie des Sciences, Paris.*

---

*Gigantic Telescope at Wandsworth Common.**

The construction of a monster reflecting telescope by the Earl of Rosse constituted for a considerable period a prominent topic of interest and conversation in the scientific world. The patience and perseverance of the noble projector under every kind of discouragement, and the unwavering faith with which, at a large outlay to himself, he prosecuted his enterprise to a successful conclusion, secured to him the admiration and esteem of all who took an interest in the higher departments of science, while the discoveries that have since been made through its instrumentality have amply borne out his anticipations and rewarded his exertions. It was necessary, however, that something further should be accomplished. To those not conversant with the subject it may be necessary to state that a reflecting telescope on a large scale must always be a work of exceeding difficulty, and comparatively limited utility. The possibility of constructing an achromatic instrument of a power equal to Lord Rosse's, and through which the object looked at could be directly magnified (as with an opera glass), has long been extremely doubtful; in fact, beyond the reach of mechanical and optical appliances. This desideratum is, however, now on the eve of being supplied.

In the course of a recent ramble on Wandsworth common our attention was attracted by a singularly looking structure, consisting of a plain tower with a long tube slung by its side, surrounded by a wooden boarding to keep off intruders. On making inquiries, we learned that it was a new monster telescope on the achromatic principle in progress of construction, under the superintendence of Mr. W. Gravatt, F. R. S., for the Rev. Mr. Craig, vicar of Leamington. Having obtained an introduction, we inspected the instrument, and ascertained some particulars respecting it which may not be uninteresting. The site, consisting of two acres, has been liberally presented by Earl Spencer in perpetuity, or so long as the telescope shall be maintained. The central tower, consisting of brick, is 64 feet in height, 15 feet in diameter, and weighs 220 tons. Every precaution has been taken in the construction of this building to prevent the slightest vibration; but, if any disappointment in this respect should arise (which, however, Mr. Gravatt does not anticipate), additional weight can be obtained by loading the several floors, and the most perfect steadiness will be thus insured. By the side of this sustaining tower hangs the

* From the London Mechanics' Magazine, August, 1852.

telescope. The length of the main tube, which is shaped somewhat like a cigar, is 96 feet, but with an eye-piece at the narrow end, and a dew-cap at the other; the total length in use will be 85 feet. The design of the dewcap is to prevent obstruction by the condensation of moisture, which takes place during the night, when the instrument is most in use. Its exterior is of bright metal, the interior is painted black. The focal distance will vary from 76 to 85 feet. The tube at its greatest circumference measures 13 feet, and this part is about 24 feet from the object glass. The determination of this point was the result of repeated experiments and minute and careful calculations. It was essential to the object in view that there should not be the slightest vibration in the instrument. Mr. Gravatt, reasoning from analogy, applied the principle of harmonic progression to the perfection of an instrument for extending the range of vision, and thus aiding astronomic research. By his improvements the vibration at one end of the tube is neutralized by that at the other, and the result is that the utmost steadiness and precision is attained. The ironwork of the tube was manufactured by Messrs. Rennie, under the direction of Mr. Gravatt. The object glasses are also of English construction, and throw a curious light upon the manner in which an enlightened commercial policy has reacted upon and promoted the advancement of science. Up to a recent period the flint glass for achromatic telescopes was entirely of foreign manufacture. Since the reduction of the duty great improvements have been made in this department. The making of the large flint glass was intrusted to Mr. Chance, of Birmingham, who at first hesitated to manufacture one larger than 9 inches in diameter. Upon being urged, however, by Mr. Craig, he has succeeded in producing one 24 inches, perfectly clear, and homogeneous in structure. Besides this, there is a second plate glass of the same dimensions, cast by the Thames Plate Glass Company, either of which the observer may use at his option. The manner in which these object glasses are fitted into the tube is a marvel of artistic invention. By means of twelve screws, numbered according to the hours of the day, they can be set in an instant to any angle the observer may require, by his merely calling out the number of the screw to be used. The object glasses also move round in grooves to whatever position it may be considered that a more distinct view can be gained. The tube rests upon a light wooden frame work, with iron wheels attached, and is fitted to a circular iron railway at a distanceof 52 feet from the centre of the tower. The chain by which it is lowered is capable of sustaining a weight of 13 tons, though the weight ofthe tube is only 3. Notwithstanding the immense size of the instrument, the machinery is such that it can move either in azimuth, or up to an altitude of 80 degrees, with as much ease and rapidity as an ordinary telescope, and, from the nature of the mechanical arrangements, with far greater certainty as to results. The slightest force applied to the wheel on the iron rail causes the instrument to move horizontally round the central tower, while a wheel at the right hand of the observer, by a beautiful adaptation of mechanical powers, enables him to elevate or depress the object glass with the greatest precision and facility. So easy, in fact, is the control over the instrument in this respect, that a very slight touch on the wheel lifts 10 cwt. It may be observed, also, that there cannot be the slightest flexure in the

tube; no error or deflexion arising from that cause can occur, while the ease with which it can be directed towards any point of the heavens will enable the observer to make profitable use of any patch of clear sky, however transient it may be. The great value of this need not be pointed to those accustomed to making astronomical observations. With respect to the magnifying power of this novel instrument, it is only necessary to state that, though the focus is not so sharp as it will be shortly, it has already separated the nebulæ in the same way as Lord Rosse's. It has separated some of the double stars in the Great Bear, and shown distinctly a clear distance of 50 or 60 degrees between them, with several other stars occupying the intervening spaces. Ordinary readers will better understand the extraordinary magnifying power of the telescope when we inform them that by it a quarter inch letter can be read at the distance of half a mile.

The preparations for this really national work have been progressing for the last two years under the superintendence of Mr. Gravatt as engineer and mathematician, but is only about three months since the superstructure at Wandsworth common was commenced, and it is already near completion.

We understand that the Observatory is likely to be endowed by its liberal and enlightened creator. It will not only be a lasting monument to his enterprising devotion to science, but an admirable illustration of the perfection to which the mechanical arts have attained in this country.

Lord Rosse has visited the Observatory, and expressed his admiration of this novel and interesting invention.—*Times.*

On the Manufacture of Hydrocarbon Coal Gas from Boghead Coal. By Andrew Fyfe, Esq., M. D., F. R. S. E.*

Continued from page 353.

I come now to consider the question of economy. Assuming that my experiments prove that there is no gain in the amount of light by the combustion of the gas from a ton of Boghead coal by the water process, a question here arises, may not the large quantity of hydrocarbon gas be manufactured at a less expense than the gas from the coal alone? That it may be so per 1000 feet we can easily imagine; but this is not the question to be solved. Gas, like other articles, ought to be paid for according to its value. The more light that 1000 feet will yield when properly consumed, the more ought to be paid for it; of course, the consumer ought to keep this in view, viz., the lower the quality of the gas that he burns, the less ought he to pay for it. I fear that this has not been attended to by those who have so strongly advocated the manufacture of a larger quantity of gas from coal by the addition of other substances, such as the "hydrocarbon" process. I enter upon this part of the subject with diffidence, because I have no satisfactory trials of my own on the results of which I can found calculations. In the trials which I have above recorded, I found that 2 lbs. of charcoal were consumed in the water retort, when 7 lbs. of coal were carbonized in the

* From the London Mechanics' Magazine, July, 1852.

other; and that, to bring out the best results, the quantity of water to be passed through the water retort required to be nearly equal in weight to the coal to be carbonized in the other. Accordingly, for each ton of coal used, it would be necessary to evaporate about a ton of water, and to consume about a quarter of a ton of charcoal, or rather of coke, to produce the requisite quantity of water gas. These would, to a certain extent, show the additional quantity of fuel necessary in the hydrocarbon process. Fortunately, however, there is no necessity for having recourse to calculations founded on these data, and to which, no doubt, objections would be raised. We have statements given of the expense of manufacturing water gas; and, though there is a wide difference between them, I shall take those given by Mr. Clegg in his report, not because I consider them correct, for I think he states the expenditure by far too low, but because they are given by one who advocates strongly the hydrocarbon process, and whose report has been extensively circulated by those who have an interest in it. Surely they will not find fault with me for adopting these statements.

In Mr. Clegg's report it is stated that 1000 feet of Boghead coal cost in the manufacture, including coals at 28s. per ton, labor, lime, fuel, repairs on retorts, &c., 2s. 11½d.—that is, 35d·5. According to Mr. Clegg, water gas, manufactured by the passage of steam over coke, cost 5d. per 1000 feet; and 1000 feet of hydrocarbon gas from Boghead coal, at 28s. per ton, will cost, including the same items, 1s. 0¾d.—that is, 12d·75; 13,500 feet being got from the ton of Boghead when carbonized alone; 52,000 feet from the ton by the water process. The comparative expense, then, of the manufacture of gas per 1000 feet, is as 35·5 to 12·75, or very nearly 3 to 1, when the quantity of hydrocarbon gas stated is got from the ton of coal. Of course, the price per 1000 feet will vary according to the quantity obtained, 5d. per 1000 feet being taken as the price of the pure water gas itself. Were the gases of equal illuminating power, then there would be a very great saving; but, in ascertaining the value of a process of this kind, the value of the gas, not only bulk for bulk, but of the total quantity per ton of coal, must likewise be taken into account. The results of my trials show that each foot of the Boghead gas gives the light of 11·79 candles, consuming 120 grains per hour, while a foot of the Boghead and water gas gives that of only 4·73 candles; consequently, to get the same light from both, for every 1000 feet of the Boghead gas used, we must consume 2490 feet of the hydrocarbon gas, and must pay accordingly for it. The consumer ought to be aware of that, and, consequently, he ought to get his hydrocarbon gas, per 1000 feet, for less than half the price that he pays for the Boghead; otherwise he is a loser by using it instead of the Boghead, or another gas of the same illuminating power as the Boghead. But, again; the important question here occurs, can the manufacturer afford to dispose of his hydrocarbon gas at this lower rate? If the statements that have from time to time been published regarding the hydrocarbon gas be correct, then he ought to do so; but, on further investigation, I fear we must come to a very different conclusion.

Assuming the accuracy of the results of my trials with Boghead, and with Boghead and water together, let us see how the matter stands; and

what I have now to say, applies not only to my own experiments, but likewise to those of Dr. Frankland and Mr. Clegg. The average result of my six trials on the Boghead coal yielded 16,093 feet of gas per ton. Take the coal at 28s. per ton, then

Cost of Coal, - -	28s., or 336d.,	or 20d·87 per	1000 ft.
Manufacture according to Clegg,	143d·775,	or 8d·934	ditto.
Total charge per ton,	479d·775,	or 29d·804	ditto.

This gas gave the light of 11·79 candles per foot—that is, 3253·5 lb. sperm per ton; 1000 feet, therefore, equal to 11·790 candles, cost 29d·8.

The average of my eight trials with Boghead and water gave 39,533 feet per ton of coal; then, as before,

Coal and manufacture,	16,093 feet,	479d·775
Water gas, according to Clegg,	23,460 " at 5d.	177d·3
Total coal and water gas, cost		597d·075, or 15d·09 per 1000 feet.

The gas gave the light of 4·73 candles per foot—that is, 3213·5 lb. sperm per ton; 1000 feet, therefore, equal to 4·730 candles, cost 15d·09. Then,

lb. sperm per ton, Boghead.		lb, sperm per ton Boghead and water.		Cost of coal gas per ton.		Comp. cost of coal gas.
3253·5	:	3213·5	::	479·77	:	473·87; and 597· : 473·87 :: 100 : 79·3.

Saving in favor of Boghead gas alone = 20·7 per cent. Again,

3213·5 : 3253·5 :: 597 :: 604·4; and 604·4 : 479·77 :: 100 : 79·3.

Saving in favor of Boghead gas alone = 20·7 per cent.

The same results are got by another process. The Boghead gas for 11·790 candles cost 29d·8. The Boghead and water gas for 47·300 cost 15d·09.

Candles per 1000 feet coal gas.		Candles per 1000 feet coal and water gas.		Cost of coal gas.		Comp. value of coal and water gas per 1000. feet.
11·790	:	4730	::	29·8	:	11·95; and 15·09 : 11·95 :: 100 : 79·1.

Saving in favor of Boghead gas alone = 20·9 per cent.

Candles of water gas.		Candles of coal gas.		Cost of coal gas.		Comp. value of coal gas.
4730	:	11·790	::	1509	:	37·6; and 29·8 : 37·6 :: 100 :: 79·2.

Saving in favor of Boghead gas alone = 20·8 per cent.

In these calculations the results do not exactly correspond, because I have not thought it necessary to extend the fractions. They are sufficient to show, that according to the results of my trials, in which the quantity of hydrocarbon gas per ton of coal was 39,553 feet of 4·73 candle gas per foot, there is an actual loss by the use of water in the hydrocarbon process to the extent of about 20 per cent.; and this loss is incurred in the manufacture of the gas, independent of other items.

I have next to advert to those instances in which the quantity of hydrocarbon gas per ton of Boghead was greater. When 52,042 feet of gas were obtained, the illuminating power per foot was on an average only

1·99 candles—that is, 238·56 grains of sperm per foot, and 1773·6 lbs. per ton of coal. Then, as before:

1 ton coal, yielding	16,093 ft.	total cost	479d·775
Water gas,	35,950 ft.	do.	179d.752, or 5d. per 1000 feet.
	52,042	do.	659d·527, or 12d·672 per 1000 feet.

One foot of gas was equal to 1·99 candles—that is, 1773·6 lbs. of sperm per ton of coal. Total cost, 659d·527.

One foot of Boghead coal gas, as before, equal light of 11·79 candles—that is, 3253·5 lbs. sperm per ton. Cost, 479d·77. Then

Coal gas = lb. sperm per ton.	Coal and water gas = lb. sperm per ton.	Cost of coal gas.	Comp. value of coal and water gas.
3253·5 :	1773·6 ::	479·77 :	261·5; and 659 : 261·5 :: 100 : 39.6.

Saving in favor of Boghead gas only = 60·4 per cent.

Coal and water gas = lb. sperm per ton.	Coal gas = lb. sperm per ton.	Cost of coal and water gas.	Comp. value of coal gas.
1773·6 :	3253·5 ::	659·5 :	1209·7; and 1209·7 : 479·77 :: 100 : 39·7.

Saving in favor of Boghead gas only = 60·3 per cent. Again,

Candles per ft. coal gas.	Candles per ft. water and coal gas.	Cost of 1000 ft. coal gas.	Comp. value of 1000 ft. coal and water gas.
11·79	1·99	29·8	5·03 ; and 12·672 : 5·03 :: 100 :: 39·69.

Saving in favor of Boghead gas only = 60·3 per cent.

Coal and water gas.	Coal gas.	Coal and water gas.	Coal gas.
1·99 :	11·79 ::	12·672 :	75·077; and 75·077 : 298 :: 100 : 39·7.

Saving in favor of Boghead gas only = 60·3 per cent.

By this mode of operating, the above results show that the coal gas is the cheaper light by upwards of 60 per cent.

That the hydrocarbon process is not economical, is also shown by comparing the lowest results I obtained by Boghead coal alone, with the highest results by the Boghead with water. The two lowest results by Boghead alone yielded, on an average, 2969 lbs., and the two highest by Boghead and water, 3619 lbs. of sperm per ton. Taking the price the same as before, then

2969 : 3619 :: 479·77 : 584·8, and 584·8 : 597 :: 100 : 102:

there is, therefore, an increased expenditure of 2 on the 100 against the water process.

Taking the *lowest* of my results by the Boghead against the *highest* by the Boghead and water, the former is as 2856 lbs. to 3649 lbs. of sperm by the latter. Take the expense for each, the same as before, then,

2856 : 3649 :: 479·77 : 612·98; and 612·98 : 597 :: 100 : 97·3.

Hence, under the most favorable circumstances for the hydrocarbon gas, the same amount of light can be obtained by the usual process from Boghead alone for very nearly the same expense; the difference being only 2·7 per cent. in favor of the hydrocarbon process.

I have next to advert to the trials of Dr. Frankland and Mr. Clegg.

Dr. Frankland obtained from Boghead coal alone 13,240 feet of gas, 1 foot of which was equal to 10·52 candles—that is, 2387·7 lbs. of sperm per ton of coal. From Boghead and water, he got 51,720 feet of 4-candle gas—that is, 3546·5 lbs. of sperm per ton. Taking Mr. Clegg's estimate of the cost of Boghead gas at 35d·5 per 1000 feet when the coal is at 28s. per ton, then the cost of manufacture of 13,240 feet is 470d., which gas yields the light of 2387·7 lbs. of sperm; the cost of hydrocarbon gas from the same coal at the same price, according to Mr. Clegg, is 12d·75 per 1000 feet, and, therefore, 51,720 will cost 659d., which is equal to 3546·5 lbs. of sperm: then—

3546·5 : 659 :: 2387 : 443; and 470 : 443 :: 100 : 94·2.

Therefore, to get the same amount of light, there is a saving on the cost price of the gas of 5·8 per cent. in favor of the hydrocarbon process, according to Mr. Clegg's calculation of the expense. Allowing the accuracy of this statement, it will naturally be asked how it is to be reconciled with that given by Mr. Clegg. In his report, Dr. Frankland alludes merely to the *increase in the quantity of gas* by the hydrocarbon process, and to the consequent *increase in the light* afforded by the combustion of this gas, without reference to expense. Mr. Clegg has, in addition to this, referred to the expenditure of manufacture, and consequent economy of the process. But in this last part of the statement he has made a very important omission. According to him, Boghead coal yields 13,500 feet of gas per ton, while the same quantity of coal affords, by the hydrocarbon process, 52,000 feet of 4-candle gas per foot, the candles burning 120 grains per hour; and he then assumes the saving to be to the enormous extent of 285 per cent. Were this really the case, it ought at once to insure the universal introduction of the hydrocarbon process. In this statement, however, the increase in the *quantity of gas* only is referred to, for—

73,500 : 52,000 :: 100 : 385.

But Mr. Clegg has not taken the *quality* of the gas into account. Had he done so, he should have stated the result very differently.

In his Report, it is said that the data on which his calculations are based are got from practical experiments made, first by Dr. Frankland, and afterwards by himself, with a view to test the accuracy of Dr. Frankland's Report. Though Mr. Clegg has not given the illuminating power of the Boghead coal gas to which he refers; but as he alludes to Dr. Frankland's experiments, which he is endeavoring to verify, we may take the illuminating power given by Dr. Frankland—that is, 10·52 candles per foot.

Taking this, we shall see the result in a very different light. 13,500 feet of Boghead coal gas cost, according to Mr. Clegg, 470d., and yield the light, according to Frankland, of 2431·7 lbs. of sperm; 52,000 feet of Boghead hydrocarbon gas, according to Mr. Clegg, cost 663d., and gave the light of 3565·7 lbs. of sperm; then

3565·7 : 663 :: 2431·7 : 446.

But the Boghead coal gas for this light costs only 470d.; and

470 : 446 :: 100 : 94·8.

Accordingly, to get the same light, the saving in the manufacture is, by Mr. Clegg's own statement, only 5·2 per cent.

Again; Mr. Clegg has stated that Boghead coal per ton will yield, by the water process, not less than 75,000 feet of 2·4-candle gas per foot, and that there is thus *an increase of* 460 *per cent.* This statement, taken in conjunction with others in the Report, is apt to lead to the impression that there is thus a gain by the hydrocarbon process to an enormous extent; we shall find, however, on further investigation that, taking Boghead coal as before, at 28s. per ton, the cost of 1000 feet of the hydrocarbon gas, when 75,000 feet per ton of coal are obtained, is, according to Mr. Clegg, 10d.; thus making the total quantity per ton amount to 787d·5. The gas per foot being equal to 2·4 candles, the light per ton of coal will be 3085 lbs. of sperm. Here, notwithstanding what Mr. Clegg has stated regarding the hydrocarbon process in another part of the Report, that there is an "increase in volume without diminution of light," we find that there is an actual loss on the previous process. 52,000 feet of 4-candle gas are equal to 3565·7 lbs. of sperm; but 75,000 of 2·4 candle gas are equal to only 3085 lbs.; there is, therefore, a loss of 14 per cent. on the total amount of light.

With regard to the cost, the gas from Boghead coal cost, as before, 470d., and is equal to 2387·7 lbs. sperm. Then

$$3085 : 787·5 :: 2387·7 : 609.$$

But the light of 2387·7 lbs., by the Boghead alone, cost only 47d.; and

$$470 : 609 :: 100 : 129·5.$$

Accordingly, to get the same light by the hydrocarbon process that we can get by the Boghead alone, there is, by Mr. Clegg's own showing, an increased expenditure of 29·5 on the 100.

In my trials, when 75,253 feet of gas were got from the hydrocarbon process from the ton of coal, the light per foot was only that of 0·27 of candle—that is, 32·4 grains of sperm per foot, or 348·3 lbs. of sperm per ton of coal, at the cost, as before, of; then

$$\underset{\text{Cost.}}{348·3 : 787·5} :: \underset{\text{Cost.}}{3253·5 : 7356}; \text{ and } 479·77 : 7356 :: 100 : 1116.$$

Here the increased expenditure for the same light is 11·16 times the cost of coal gas alone, showing still further the loss incurred by the water process.

In the trial in which the quantity of hydrocarbon gas per ton was smaller than those above given, a loss is also occasioned. When the gas was 24,932 feet per ton, the illuminating power per foot was 6·52 candles—that is, 78·24 grains of sperm, or 2786·6 lbs. per ton of coal.

	Per ton.	
Cost of Boghead gas, as before,	16,093	479d·77
Water gas,	8,839	44d·19
Total cost,	24,932	523d·96, or 32d·5 per 1000 feet.

Then, $2786·6 : 523·96 :: 3253·5 : 612·1$; and $479·77 : 612·1 :: 100 : 125$.

The extra expenditure is in this case 25 per cent. for the same amount of light that I get from Boghead alone.

All of these statements still further prove that the hydrocarbon pro-

cess not only is not economical, but, when carried to a great extent, is an expensive one; and it must be kept in remembrance that the above calculations refer solely to the cost of manufacture. There is no allusion to the enlarged gasholders, pipes, &c., necessary for the increased amount of gas that must be supplied to obtain the same light that is got from Boghead gas, and all of which must add materially to the expense.

I have said that there is a wide difference between the statements of Mr. Clegg and others regarding the expense of manufacturing water gas. Mr. Clegg says that it can be made at the cost of 5d. per 1000, which includes expense of materials, labor, tear and wear, &c. In the June number of the *Journal of Gas Lighting*, reference is made to the experiments of Magnier and others, from which it is inferred that the expense will come to 12d. From data given to me by a gas engineer of this place, it would seem to be not less than 10d. If these statements are correct— and I believe that the last-mentioned is below the mark—then the expense of the manufacture of gas by the hydrocarbon process must be far greater than what Mr. Clegg has given it, and, consequently, the loss by the use of water must be still greater than I have stated it to be.

It must, also, be kept in recollection that the expense of manufacturing gas must vary in different places, not only because the cost of materials differs, but likewise because the expense of labor, outlay on tear and wear, according to the extent of the works, is different. In taking the expenditure as given by Mr. Clegg, I have, I think, taken it at a low estimate.

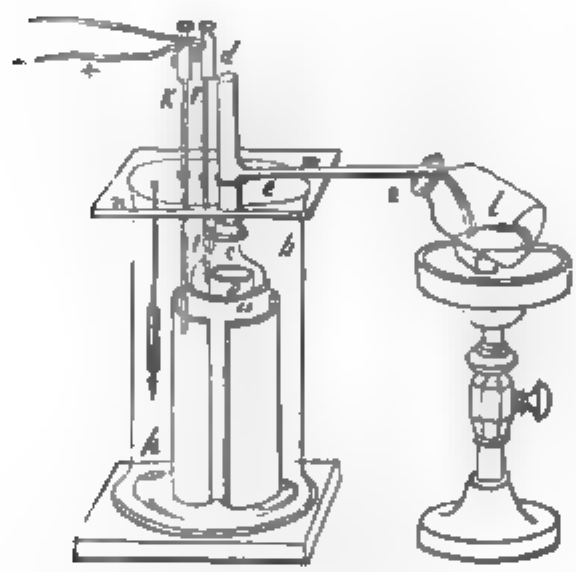
The preceding remarks regarding the hydrocarbon process refer alone to its application to the Boghead coal. I have already said that I preferred that coal to others, because from the large per centage of matter condensable by chlorine which its gas contains, I considered it by far the most likely to be affected beneficially. It was my intention to extend my trials to other coals, had I obtained anything like a saving with the Boghead coal. The results of the trials I have now recorded, render it, in my opinion, quite unnecessary to take up time in trying the process with other coals. I trust that what has been written will be sufficient to prove that there is no economy in the hydrocarbon process, and that, when all things connected with the manufacture and quality of the gas are taken into account, it is a process which ought to be at once abandoned.—*Journal of Gas Lighting.*

Translated for the Journal of the Franklin Institute.

On the Flow of Liquids from the Positive to the Negative Pole of a Closed Galvanic Battery. By M. Wiedemann.

Independent of the magnetic, physiological, heating, and chemical actions, the galvanic current possesses besides, a peculiar force by which it transports materials from the positive to the negative pole. In reference to this, the author undertook a series of experiments, endeavoring to reduce the phenomena to some simple fundamental principle. Of

several different arrangements the following apparatus appears to be the simplest and most suitable:—



Upon a porous earthen cylinder, *a*, closed below, a small tubulated bell glass, *c*, was cemented, into the tubulure of which was introduced a perpendicular tube, *d*, with a lateral discharging tube, *e*. In the earthen cylinder is placed another cylinder of copper or platinum, *g*, with which a wire, *f*, leading to the negative pole of a galvanic battery, is connected. This wire passes through a glass tube carefully cemented to the upper part of the bell. In addition, the earthen cylinder is surrounded by a second cylinder of sheet iron, communicating with the positive pole. The whole apparatus is enclosed in a large glass jar, *h*, which, together with the earthen cylinder of the apparatus, is filled with water or some other liquid. The intensity of the current was measured by a galvanometer. As soon as the current is closed, the liquid rises in the earthen cylinder, and flows out by the discharging tube into a graduated vessel, *i*, placed below it.

By noting the quantity of liquid discharged, and using currents of different forces, the conclusion is, that *the quantities of liquid discharged in a given time are directly proportional to the intensities of the currents.*

When the conducting surface of the earthen cylinder was diminished gradually, by varnishing it, all the other circumstances remaining the same, *the quantity of liquid discharged was independent of the size of the surface.*

In the same time that a current of given intensity caused the discharge of three cubic centimetres of water from the earthen cylinder, the same current developed in the voltameter placed in its current about one cubic centimetre of explosive gas.

Although these laws already explain the general principle of the transporting action of the current, and although it necessarily follows that this action is independent of the particular causes of capillarity and endosmose, nevertheless, all the phenomena which show themselves when a liquid flows through narrow orifices, exercise a peculiar influence on the results above given.

M. Wiedemann consequently sought to find a method of measurement, independent of these phenomena, by annulling the action of their force by a simple hydraulic counter-pressure. The tube placed upon the earthen cylinder of the apparatus was closed on top, and the discharge tube, *e*, was placed in communication with a mercurial gauge. Using different currents and different amounts of cylinder surface, the mercury in the gauge rose to different heights. It results from the measurements, that *the heights to which the liquids under the influence of a galvanic current rise, are directly proportional to the intensity of the current, and inversely as the free surface of the cylinder.*

According to the results of the experiments, the pressures are to the intensities of the currents, in the same ratio as the quantity of liquid discharged by this current in the same time—a result which accords with the laws of the flow of liquid through narrow orifices.—(*Hagen, Poiseuille.*)

By means of the laws above announced, we may establish the transporting action of the galvanic current on the simplest fundamental principles.

Let there be on the two sides of a given section of a certain liquid, two plates immersed at a certain distance from each other, and presenting an electric tension in reference to each other. This section produces in the liquid a current which, if all the circumstances remain the same, is proportional to the tension itself, and to the section of the liquid. Moreover, this current draws the liquid from the positive to the negative pole, with a force equivalent to a hydrostatic pressure directly proportional to the intensity of the current, and inversely as the section of the liquid. It follows directly from the combination of these two conditions, that the force with which the tension subsisting on the two sides of a transverse section of a given liquid, transports that liquid from the positive to the negative side, corresponds to a hydrostatic pressure directly proportional to that tension.

By means of this theorem, we have a simple measure of the electric tension, and of its mechanical action, in terms of the atmospheric pressure and also of the unit of weight. The laws heretofore expressed apply only to liquids of the same nature. When the liquids are different, there is presented, at least in the mechanical action of the current, a difference which is important, and so much greater, because with equal intensities of current, liquids of great resistance transport in the same time a greater quantity of galvanic current than liquids of feeble resistance. Unfortunately, it has not been yet possible to determine the relation which exists between the mechanical action of the galvanic current and the resistance of the liquids which it traverses, on account of the imperfection of the means of appreciating and measuring these resistances. We must, therefore, as yet consider it as an isolated observation, that among the solutions of sulphate of copper of different degrees of concentration, the resistances of which have been recently determined by Mr. Becker, *there passes in the same time through the same earthen well, currents whose quantities are nearly proportional to the squares of the resistances.*

For the Journal of the Franklin Institute.

On the Manufacture of Sugar.

For a few years back, hardly a month has passed that has not brought forth some new process by which we were to obtain a great result at a very small expenditure, and the following article, taken from the London *Morning Chronicle*, will show on several points how much ignorance prevails among those who intend to revolutionize the manufacture of sugar, and to destroy the *molasses* business forever.

"*New Mode of Manufacturing Sugar.*—The new processes are fourfold

in their character, comprising, first, a new mode of obtaining the saccharine juice from the cane; secondly, a new mode of defecating and filtering the juice so obtained; thirdly, the boiling and concentrating of the juice; and fourthly, the crystalization and final curing of the sugar. The varied processes are to be seen at a model sugar house, at the works of Mr. Bessemer, Baxter house, Old St. Pancras Road, London. By the first improvement, in the construction of the cane press, a difference in the yield of the cane is obtained, as compared with the old rolling mill, of about 20 per cent. In the new machine, the pressing tubes are reduced in length from 30 inches to 12, the first four of which are parallel, and three inches wide—the next four inches of their length being taper, and terminating with a width of but 1½ inch, the smaller contracted point extending as far as the exit end of the tube. By this change of form, the entire removal of the elasticity in the "magas" occupying the tubes is removed, and after the cane has been collapsed by the severe pressure, and its breadth at the same time gradually lessened, every fibre and cell is made to assume new relative positions; not one remains unruptured, and an increased quantity of the juice is consequently expelled at the trough. In addition to this advantage, there is obviously a more equal distribution of power in each revolution of the machine; the deleterious chlorophyl, or coloring matter, of the outer portion of the cane, is not expelled with the juice, as in the ordinary apparatus; the machine may be more easily fed, and weighs considerably less than rolling machines generally in use.

"The juice, when expelled from cane, is unavoidably mixed with numberless minute fragments of cellular tissue, albumen, and other extraneous matters, which, if not speedily removed, tend to produce the acidification of the liquid. At this stage comes in the second of the processes invented by Mr. Bessemer. The present mode of defecation and filtration consists in raising the temperature of the liquor to 150° Fah., when a quantity of lime is thrown in for the purpose of neutralizing the free acid, and assisting in the coagulation of the albumen; the temperature is increased to 180° Fah., when, after allowing time for settling, the scum is removed, and the clear liquor drawn off into the "grand" copper, where it is subjected to boiling heat, when the feculent and other albuminous matters are kept constantly removed from its surface. The more completely these impurities are removed, the greater will be the brightness and value of the finished product. In the new process the juice passes through a wire strainer direct from the spout of the mill into the clarifiers, where it is raised to boiling heat by the application of steam, at which temperature it is kept for about three minutes, by which time the whole of its albuminous constituents and feculent matters will have been coagulated and chemically separated, but will, of course, still remain mechanically mixed, and, in the form of light flock, pervade the entire bulk of the fluid. These substances are then effectually removed, by a process similar to that employed in the manufacture of paper. A drum of about two feet in diameter, and from four to five feet in length, is made to revolve slowly in a small semi-circular tray or vessel. This drum is covered with fine wire cloth, through which the water forces its way, leaving a muddy coating of extraneous matters on the outer side,

which coming in contact as it revolves with a fixed scraper, similar in principle to the "doctor" employed in calico printing, is made to fall off in a state something like dry mud into a receptacle prepared for it. The process is self-acting. It takes in its own supply of foul liquor from an elevated cistern, delivers the clear juice into the evaporating pan, and discharges the refuse as we have already stated.

"Up to this stage the advantages obtained must be evident to all who are acquainted with this interesting branch of manufacture. The liquor being received direct from the press, avoids the necessity of the use of liquor pumps; the clarifiers not being used as subsiding vessels, are not required to be so large; the loss of juice in the removal of the scum, and in the sediment, is prevented; the use of the "mont-jus" is rendered unnecessary; the coagulation of the albuminous matter is more rapidly obtained; the evaporating process may follow immediately after the pressing of the canes; and, finally, the self-cleansing filter performs its work much better than any continuous process of skimming, and renders unnecessary that watchful attendance which is now so imperatively necessary in order to obtain the required brightness and color of the sugar. The saving of manual labor by these improvements is self-evident.

"On the various modes of boiling and concentrating the juice at present in use, whether by a series of semi-globular pans, the vacuum pan, Gadsden's pan, or the apparatus of Mr. Crossley or Mr. Schroder, it is not necessary now to speak, the principle involved in one and all of them being the same—that of evaporating the fluid from the saccharine matter. The inventor of the process now under consideration, contends that, in all the existing arrangements for the separation of the water from the sugar, boiling under any form, or the use of surfaces or pipes heated by steam, must be totally excluded, if the formation of molasses is to be prevented. It is a well established fact, that a thermometer placed in a solution heated by steam or the direct action of fire, furnishes no indication of the temperature to which the liquid is exposed, as a vast amount of latent heat is absorbed by fluids in their formation into steam. To the forgetfulness of this simple fact are to be traced many of the fatal mistakes at present connected with the manufacture of sugar.

"Thus, while the temperature of the syrup during ebullition in a vacuum pan, indicates as low perhaps as 180 degrees Fahrenheit, the copper worm, against which portions of the sugar are constantly brought into contact, is equal to and often above 226 degrees Fah., the consequence of which is the destruction of the color, and an injury to the crystallizing powers of the sugar. By an arrangement which Mr. Bessemer terms a hot air evaporator, the concentration of saccharine fluids may now, however, be effected without the slightest injury to color or quality, and in an increased quantity.

"This apparatus consists of a tank of thin plate iron, of about 10 feet by 8 feet, and 2½ feet in depth, which has a false bottom, curved so as to form two parallel segments of a cylinder. Above these and coincident with them is a hollow drum, of 18 inches in diameter, mounted on an axis, and on which is formed a broad spiral blade in the shape of a screw or "creeper," the thread of which is about fifteen inches in depth, and the convolutions three-quarters of an inch apart: and between each

of the blades or threads of the screw, holes are formed spirally from one end of the drum to the other. At one end of the hollow drum, air, supplied by the blowing fan, and heated to 150 degrees by passing along a flue, is made to enter, which escapes through the holes in the drum in a radial direction, and sweeps like the hot breath of the simoom over the wet surfaces of the various revolving blades, absorbs the moisture thus exposed to its action, and passes off in an invisible vapor.

"Upwards of six thousand square feet of evaporating surface is thus obtained in the small space of 10 feet by 8 feet. The screws make about eight revolutions per minute, and as they revolve, the more concentrated portions of the fluid are washed off as they descend into the fluid, and fresh portions are being constantly brought up on the surface of the screw, to be in like manner subjected to the hot-air blast. Finally, after three or four hours, the whole of the surplus liquor is carried off; the remaining fluid is sufficiently concentrated, and assumes a thick gelatinous appearance; and the screw, made to revolve in the opposite direction, expels the solution from the tank ready for the process of crystallization. By this process the sugar is not at any time exposed to a hotter surface than 140 degrees. No boiling, consequently, takes place, no slea is formed, and not one grain of crystallizable sugar is converted into molasses. The entire cost of fuel for evaporation is saved, the waste heat of the chimney and waste steam of the engine being alone employed, and the apparatus costs less than the ordinary vapor pans; it can be worked with a small amount of wind or water power. Three hogsheads of sugar, it is stated, can be obtained where two only are now produced, whilst the quality will be superior in color and taste, and will be perfectly free from molasses.

"The separation of the crystals from the mother liquor in which they are found is effected in a most ingenious and efficient manner by the use of the air pump. The transformation from the most repulsive and unwholesome-looking black sugar into a fine white sugar is completed in one-seventh of a second by this process. The principle adopted is precisely that employed in 'gassing' lace—an operation resorted to for the purpose of removing the minute filaments of cotton adhering to the surface of the fabric. In the case of the crystals of sugar, a thin film of fluid matter is required to be removed from the surface of the crystal, and this is effected by bringing it in contact with water—a material which would as quickly dissolve the crystal itself, as the flame of the gas would destroy the delicate and fragile web of the bobbin net. How can the water be thus brought into contact with the sugar for such a short period, and in such a manner as only to remove the outer coating of molasses, and leave the crystal uninjured? The process is a very simple one. A table of nine feet in circumference is made to revolve eight times per minute, having a coating of sugar spread over it to the depth of half an inch, and which consequently moves over a space of 72 feet per minute. At one part of its revolution the table is made to pass under a pipe of two inches in diameter, from which a shower of water is falling, and as the pipe is but one-sixth of a foot in diameter, and the table passes it at the rate of 72 feet per minute, it follows that each portion which comes under the

falling water will be retained only $\frac{1}{432}$ of a minute in each revolution. This table being covered with thin brass wire gauze, has placed immediately under it a vacuum chamber, into which the falling water, carrying with it the semi-fluid coating of molasses, is drawn as the table revolves, the crystallized sugar remains on the surface pure and white, and is delivered by a scraper into the hogshead placed for its reception."

Mr. Bessemer, it appears, has a new machine, by which he presses juice from the cane, which acts by a series of compressions at a high velocity, instead of the slow process of rollers. Mr. B., without saying what per centage of the weight of the cane is obtained in juice by other modes of operation, states that *he* obtains 20 per cent. more. On the best estates in the island of Cuba, having sugar mills with great length of rolls and a velocity of 2½ revolutions per minute, (diameter of rolls being from 26 to 30 inches,) 70 per cent. of the weight of cane is obtained in juice; if to this you add 20 per cent. the yield will be 84 per cent., which is considerably more than the cane contains; from 70 per cent. by good management, the product falls off to 50 per cent. by bad.

We are also informed that by the *new process*, the cane juice passes directly from the mill through a wire strainer into the clarifiers. Considering that precisely this process has been in use for at least twelve years, wherever steam trains have been in operation, it is rather a bold declaration to call it new.

Mr. B.'s next improvement is the substituting currents of hot air (for the purpose of evaporation) in the place of steam; to make this necessary, he informs us that while the temperature in a vacuum pan may be as low as 180°, still the copper tubes by which it is heated will show 226°. He is probably only acquainted with the ordinary Howard pan, and is not aware that in this country and Cuba, there are many apparatuses in which the temperature of the sugar in the vacuum pan does not exceed 150°, and the temperature of the steam used is only 212°, being barely of the pressure of the atmosphere; this result is produced by having increased surface for the steam to act upon, and has been in operation several years.

After the peculiar process of evaporation adopted by Mr. B., has been in operation for three or four hours, we are told that the result is a mass of crystals of sugar, not *one grain* having been converted into molasses.

Now, although he states that not one grain has been converted into molasses, still he has given to each grain a covering which he calls mother liquor, (a new name for an old friend,) and this mother liquor he removes by putting the sugar on a circular table of wire having a partial vacuum below it, and as the sugar passes under a fine stream of water, the mother liquor is drawn through into a receptacle below. If this mother liquor and water do not form molasses, what do they form? We should like to know. The only thing new that Mr. B. has produced is, his method of extracting the cane juice, and also of evaporating by means of heated air; and I venture to say that on trial both of them will be found defective.

B.

Translated for the Journal of the Franklin Institute.

New Uses of the Leaf of the Pinus Sylvestris.

Not far from Breslau, in Silesia, in a domain called *la Prairie du Humboldt*, exist two establishments, equally astonishing on account of their objects and of their connexion; one is a manufactory in which the leaves of the pines are converted into a sort of cotton or wool; the other offers to the sick, as a salubrious bath, the waters left from the making of this vegetable wool. Both were founded under the direction of the head Inspector of Forests, M. de Pannewitz, the inventor of a chemical process, by means of which, from the long and slim leaves of the pines is procured a very fine filamentous substance, which has been called *wood-wool* (*laine de bois*), because it curls, felts, and may be spun like common wool.

The *pinus sylvestris*, or wild-pine, whence this new product is procured, is already much esteemed in Germany on account of several valuable advantages which it presents; and in place of abandoning it to its natural growth, extensive plantations of it have been formed, which are true forests. When planted on light and sandy soils, which it prefers, and in which it grows with the greatest rapidity, it gives them consistence and solidity. Associated with the oak, it becomes a shelter, under the shadow of which this latter acquires a great strength of development, until in its turn it rises above its protector. When the pine has reached its fortieth year, it furnishes very profitable crops of rosin. Its wood is esteemed for buildings, &c. The employment which M. de Pannewitz has proposed to give to its leaves, will without doubt contribute to spread still more the culture of a tree already so useful, and will perhaps give it some favor in other countries, where it is scarcely known.

All the acicular leaves of the pines, the firs, and coniferous trees in general, are composed of a bundle of fibres extremely fine and tenacious, which are surrounded and held together by a resinous substance in thin pellicles. When by heat, and by the employment of certain chemical re-agents, the resinous substance is dissolved, it is easy to separate the fibres from each other, to wash them, and to free them from all foreign bodies. According to the method used, the wooly substance acquires a finer quality, or remains in a coarser state; and in the first case it is employed as wadding; in the second, as filling for mattresses. Such in a few words is the account of the discovery due to M. de Pannewitz.

In practice, the *pinus sylvestris* has been preferred to others because it has the longest leaves. There is no reason to doubt that in the countries in which other species of pines exist with equally long foliage, the same product may be as advantageously obtained. There is no danger in stripping the pine of its leaves, even in its youth. This tree has need for its growth only of the whorls of leaves which terminate each branch; all the leaves which surround the rest of the branch may be stripped off without doing any harm. The operation must take place while they are yet green, for it is only then that they can serve for the extraction of the wooly substance. The stripping of the leaves is the province of poor people, and pays them good wages. The operation can only be performed every two years. The product of each gathering is one pound of

leaves for a branch of the thickness of the finger. A beginner can gather thirty pounds per day; an experienced hand may get as much as one hundred and twenty. The profit is greater from a felled tree than one standing.

The first use which was made of this filamentous substance was to substitute it for cotton wadding in quilted coverlets. In the year 1842, the hospital of Vienna bought five hundred of these coverlets, and after using them for several years, renewed its orders. It was remarked among other things, that under the influence of the pine-wool, no kind of parasitic insect harbored in the bed, and the aromatic odor which they emitted was considered to be agreeable and beneficial. Soon afterward, the penitentiary of Vienna was provided with the same kind of coverlets. Since then they have been adopted, as have been also mattresses filled with the same wool, in the hospital *La Charité* at Berlin, and at the hospital *La Maternité*, and the soldiers' quarters at Breslau. An experience of five years in these establishments, has shewn that the *wood-wool* is well fitted for use in coverlets, and for wadded goods, and is very durable.

At the end of five years, a mattress of *wood-wool* had cost less than one of straw, which required the addition every year of at least two pounds of fresh straw. Furniture, in the construction of which this matter was used, was preserved from the attacks of moths. It cost three times less than hair, and the most skilful upholsterer could not distinguish an article of furniture in which it is used from a similar one stuffed with hair. We are besides assured that it may be spun and woven. The finest gives a thread resembling that of hemp, and is as strong. When spun, woven, and finished like cloth, it furnishes a product which may be employed for carpets, horse-furniture, &c.; when interwoven with a warp of linen, it may be used as bed-coverings. The products of the manufactories of *Zuckmantel* and *La Prairie du Humboldt*, gained for their present owner, *M. Weiss*, a bronze medal at the exhibition of Berlin, and a silver medal at that of Altenburg.

In the preparation of the *wood-wool*, there is produced an ethereal oil with a sweet odor. This is at first of a green color; exposed to the light, it takes an orange-yellow color; when carried into a dark place, it regains its green color; by rectification, it becomes as colorless as water. It has been shewn to differ from the essence of turpentine which is extracted from the stem of the same tree. Employed in various rheumatic and gouty affections, and applied as a balm upon wounds, it has produced salutary effects; as also in vermicular affections, and in the case of certain cutaneous tumors. When rectified, it answers as an excellent oil in the preparation of the finest lacs which form the base of varnishes, and has been burned in lamps like olive oil; it dissolves caoutchouc completely, and in a short time. The perfumers of Paris use quite a large quantity of it.

It has been found that the liquid residuum which the boiling of the pine-leaves leave, exercises a very salutary action when employed as a bath; so that a bathing establishment has been annexed to the manufactory. This liquid has a greenish color verging on brownish: according to the circumstances and the mode of preparation, it is either gelatinous and

balsamic, or acid; in this latter case prussic acid is produced. During the nine years since the establishment of the baths, their reputation and the number of its visiters have been constantly increasing.

When it is necessary to augment the efficacy of the baths, there is added an extract obtained by the distillation of the ethereal oil of which we have spoken, an extract which also contains prussic acid. The liquid residuum is also concentrated to the consistency of a liquid extract, and then enclosed in sealed vessels, to be used for baths at home.

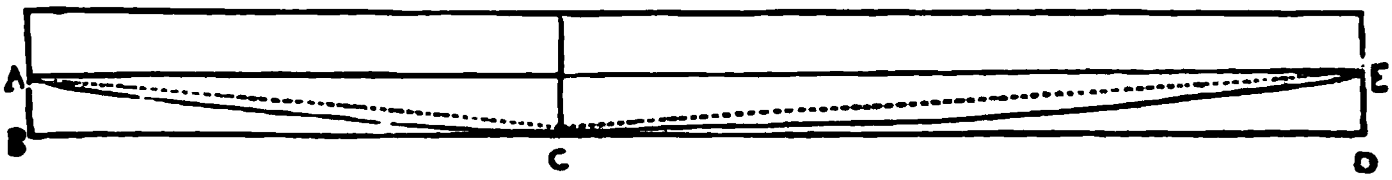
The membranous substance which is obtained by filtration when the fibre is washed, is put in the form of bricks, and dried; it then serves as a combustible, and produces a large quantity of gas for lighting, which comes from the great quantity of resin which it contains. Henceforth, it may be used for heating and lighting the manufactory.—*Bib. Univ. de Genevi., June*, 1852, *p.* 165.

Hints on the Principles which should regulate the Forms of Ships and Boats; derived from original Experiments. By Mr. William Bland, *of Sittingbourne, Kent.**

Continued from page 316.

Chapter XVI.

The six models just treated of were all with flat bottoms, and this for the sake of convenience. The forms calculated for service must have the curve along the bottom, as shown to be so necessary in Experiments 33 to 36. They must have, likewise, the keel deeper towards and at the stern than towards and at the stem (See Experiment 5); again, the space between the curve along the bottom and the keel must be filled up at both stem and stern; and so constructed as to offer at the bows, from the cutwater to the midship, the least resistance possible to the water; and from the midship to the stern post, to afford the easiest and most direct passage for the water, that it may act to the best advantage against the sides of the rudder.



Upon an inspection of the accompanying diagram, it will be seen that the part cut off the flat bottom by the curve A C E, equals nearly the triangles A B C, and C D E; but since a portion of the triangles will be made up by the sharp bows and body situated between the keel and the line of curvature along the bottom, it will occupy the space of about half the cubic parallelogram: therefore a quarter part only will be necessary to add to the depth at the midship section for the load-line of flotation. Upon testing the above by two models, one with a flat bottom, the other curved and yet left filled up, as required between the curve and the keel, the displacement in the water gave a quarter part as the

* From the London Civil Engineer and Architect's Journal, November, 1851.

exact difference. This proportion of a quarter part to be added to the depth at midship, applies to all the six models, from their similarity in flatness; therefore, the depth at their midship section for the load water-line should be increased by one-quarter part of their draft, when having a flat bottom at midship.

On turning back to those experiments which relate to the depths of keels, commencing with No. 44, it will be seen that the flat bottomed model (No. 2) required no keel; likewise the triangular midship model No. 3; but to the forms Nos. 1 and 4, keels were necessary.

Before deciding upon the midship section best calculated for service, it will be right to criticize those sections which have been already tested. To this end, it will be advisable to review the Experiment 41, where it appears of the triangular model No. 3, that its speed equalled Nos. 2 and 4, the latter having been previously made elliptic. In lateral resistance, No. 3 possessed the same as No. 2, Experiment 54. In stability, No. 3 proved the worst of the four (see Experiment and Table, &c., after No. 43). Lastly, in depth or draft, No. 3 again exceeds all the others. The conclusion to be drawn from the preceding facts are of such a nature as to justify the rejection of the triangular form of midship.

The semicircular form of midship (No. 1), possessed speed as one good quality; but which advantage is counterbalanced, first, by its circular outline being conducive to rolling; next, the depth at which it floats; and third, its deficiency in stability. These evils, it must be admitted, are highly objectionable, and warrant the rejection of the semicircular midship section, except where speed only is sought, when the employment of iron or lead ballast can be had recourse to as a corrective of its instability.

There remains to be considered the flat bottomed model No. 2, and the elliptic one No. 4.

The model 2, (as shown in Experiment 41,) is inferior in speed to No. 1; but as regards all other qualities, so essential to every ship, particularly for burthen, very far the superior,—1st, in floating depth (see Experiment 43); 2d, in not rolling; 3d, in lateral resistance (see Experiment 44); 4th, in stability, the means of speed (see Table, after Experiment 43).

The elliptic midship model (No. 4), as stated in the several experiments before adduced, is equal in speed to No. 2, but is slightly inferior to the same model,—1st, in depth of flotation; 2d, by rolling more; 3d, by having less lateral resistance; 4th, by possessing less stability.

The next point to be considered, before finally deciding upon the midship section, is that part of a ship's midship which is above the load water-line—meaning the sides; whether they should be continued up perpendicularly, or slightly inclined outwards, so as to present at the lee-side a larger bearing on the water, to operate in an increasing ratio against the force of the wind upon the sails.

The Experiment 63, shows that the stability of the model (No. 1) having right-angled sides, equalled the stability of the model No. 2, with its sides inclining outward; and when both were lightened, the influence of the sides which inclined outwards became apparent in the stability remaining unaltered; whereas, in No. 1, the stability was improved to the amount of half-an-ounce; consequently, there appears no

good reasôn for giving a preference to the beveling-out sides, over those carried up perpendicular.

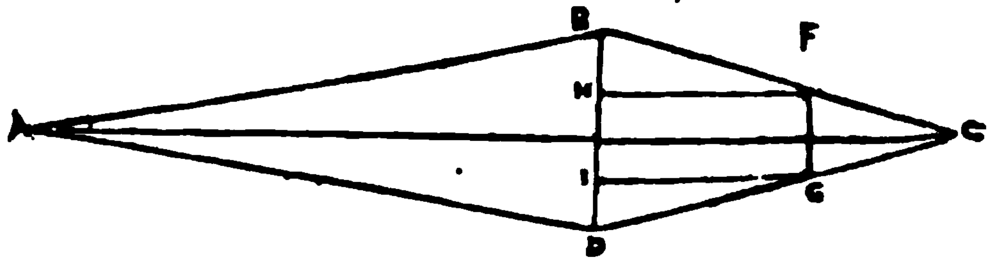
From what has been elicited, it appears that any approach to the triangular midship section has its stability improved materially by ballast, or weight; for, in fact, it is indispensable, since it possesses none without ballast.

Chapter XVII.

The criticism of the four models of midship section being concluded, the inference to be drawn from it is, that (No. 2) the flat bottom, exceeded all the others in the essential qualities for a ship of burthen. But since speed is now become so essential a quality in a ship, those curves must be adopted which have been proved so advantageous in Experiments 33, &c., Chapter VIII.; and in consequence, the flat bottom can only be preserved entire at midships; thus making the addition of a keel absolutely necessary, both before and after that point. No. 4, the elliptic form, comes next. When carrying out the experiments undertaken, with the object of ascertaining the effects of additional weight, for the purpose of gaining an increased depth of flotation in the six models, it came out that a certain few of the models were influenced in their stabilities differently from the others.

The models in question were those which partook of, and approximated in their forms to, the parallelogram and square, and of the oval and circle; and in these the stability increased with the additional weight. On the other hand, the long fish and bird shape models ceased to improve in their stability after a certain amount of weight, they having, as it were, an early limit to any further increase of the same. This peculiar characteristic (and confined almost to the two models Q and R), is of great moment when selecting forms for various purposes; and the cause of the same must be looked for in the narrowness or sharpness of such craft, particularly towards their head and stern.

The Experiment No. 8 and Table C, exhibits No. 2, with one-fifth of the base or beam for the depth of flotation, as possessing the greatest stability. Now, admitting the depth of flotation to be one-fifth at the midship, then the depth from the midship towards both head and stern must be greater than one-fifth; indeed, be in an increasing ratio as the distance nears those extremities; consequently, the stability diminishes proportionally, as shown in the same Table C, in No. 5, being inversely to the length. Thus throwing the support of such parts upon the superior stability about the midship section; which, therefore, must necessarily be reduced. The annexed diagram will explain the meaning.



Let A B C D be the model, and B D the midship section. Take any point in the sides B C and D C, as F, and draw the line F G, parallel to B D; likewise, draw F H, and G I, parallel to A C, cutting B D in H

and I. Now, it is well known, that the straight line F G equals the straight line H I, which is part of the line B D. H I is less than B D; so also must be its equal F G.

From hence it follows, that since B D is greater than F G, then is one-fifth of B D likewise greater than one-fifth of F G; consequently the stability is proportionally less. The same can be shown of every line that may be drawn parallel to B D, between B D and the extremities A and C.

Chapter XVIII.

Presuming thus far as correct, the difficulty then almost vanishes in relation to models or forms of ships for particular services.

To begin with boats intended for speed, and to be impelled forward by the oar. Now, it has been seen in Table No. 1, of the difference in speed between the six models when towed through the water, that the model I proved the swiftest. This model, in its proportion of length to breadth, is seven times the breadth. If greater speed be required, then eight, ten, or more times the breadth may be selected, the midship section being semicircular, and to be situated at the middle of the length (see Experiment 75), or from that to an ellipse; but the utmost care will be requisite to prevent upsetting, from its deficiency in stability.

For a steam vessel upon rivers, and without the aid of sails, seven times the beam or breadth as the length will be found to answer very well, with the midship section semicircular, and at the mid-length (see Experiment 75), or nearly so. Here iron and lead as ballast will greatly improve the stability; but then it will act as an extra load to carry.

When boats and steam-vessels are to have the assistance of sails, the length should be about five times the breadth, as the model O.

For yachts, which are vessels for speed only, and impelled forward by sail, and in consequence great stability required, then the model R, or between R and T, is the one most applicable for the purpose. The floating depth, according to Table 4, must be very shallow, yet the keel with the bottom tapered should be made to descend down into the water sufficient to obtain the requisite lateral resistance, having the lower spaces filled with iron ballast, to further improve the stability for racing purposes; the masts, &c., being made proportionally strong.

Sea fishing boats should closely resemble the model R also, because, although required for burthen rather than speed, great stability is absolutely necessary for the sake of safety, since such craft rarely have decks. Besides this, the cubic capacity of the form R is great, and at little cost, which is a consideration with fishermen. The sides also should be carried up high, both for safety and burthen.

The model Q presents the best form and requisites for the merchant service, which is made evident in Table No. 3. The proportion of its length to breadth is three and a-half the breadth. In the same Table (No. 3), it appears, that when the oblong form of model, as P, is in length five times the beam, and possessing, as is there noted, greater stability than the model O, yet the model O beat P, and with less surface

of sail, which is an advantage as requiring less weight of masts and yards.

Lastly, for ships of war, the model Q is here again pre-eminent for this purpose, particularly for the largest rates; because, in the first place, the stability increases in a degree with the load; and in the second place, of the greater bearing on the water at and towards both head and stern; and in the third, of the almost parallel sides, which afford every facility for the carrying of guns, with space to work them; but draft in the water should on no account be great, because speed is too essential a quality to be dispensed with in a man-of-war.

Chapter XIX.—The Positions of the Centre of Gravity, of the Centre of Lateral Resistance, and the Centre of Force of the Sails.

The position of the centre of gravity in a ship, with regard to its height above the keel, should not exceed when loaded, the line of the surface of the water (see Experiment 8, Table C); otherwise it will lose stability and become top-heavy. If situated much lower than the water-line, the stability will certainly be improved; at the same time, a greater strain than needful will ensue upon the vessel, and thus endanger the breaking of the masts and yards, if they be not of sufficient dimensions to meet it. When the axis of the centre of gravity, considered lengthwise of a ship, exactly corresponds with the surface of the water, the rolling will be easy as far as the height of the said gravity is concerned; but the form of the midship section has a very great influence in checking or increasing such motion. The distance from the head and stern in a ship at which the position of the centre of gravity had best be fixed, requires no small degree of reflection, and must be decided before the laying down of the keel, because the circumstance involves both the places of the centre of lateral resistance, and the centre of force of the sails.

The sole fish has the centre of gravity in the widest part of its breadth, and which, therefore, is its centre of motion. The distance of this point from each extremity of the fish is just two-fifths of its length from the head, and three-fifths from the tail; consequently, gives one-fifth as the excess of leverage at the tail over that at the head. In a fish this is most essential, because it derives its power of locomotion chiefly from the rapid, lateral, and curved movements of the tail.

A ship, which is a body impelled forward by sails, could by no means answer if constructed altogether upon the principle of the sole fish; and chiefly on account of the centre of gravity being so forward, as stated. The consequence in practice, from the great distance apart of the centres of gravity and lateral resistance, would be a perpetual conflict against each other for the centre of motion, at the positive disparagement of the speed; for, first, the influence of gravity would place the centre of motion at two-fifths of the length from the cut-water; second, the lateral resistance would operate to carry back the centre of motion towards the centre of length; and third, the centre of the force of the sails, if not situated well a-head by means of a long bowsprit, would be perpetually causing

the ship's head to fly up into the wind. From all that has been stated, it appears in every way impolitic to have the centre of gravity situated too far forward.

In Experiments 73, &c., of the six models, it is shown that their centres of gravity taken in the solid state of the models themselves, previous to their being hollowed out—and, therefore, their true centres being likewise centres of displacement with regard to length—are situated forward and a trifle more than their mid-length. Now, if the centre of lateral resistance be influenced by the head resistance, the two centres, namely, of gravity and lateral resistance, would merely coincide. To accomplish this point, which insures the perfection, in a great measure, of easy sailing and steering vessels, it must be done through attention being given to lateral resistance at the time of making the design, as by well slanting the cut-water, without however losing a good foot-hold, and deepening the keel towards and at the stern—whose post should be perpendicular, for length of keel operates with the best effect in improving lateral resistance, whereas the deepening of it acts to overturn, and thus lessens the resistance (see Chapter XI.),—by this means, the two centres of gravity and lateral resistance will be made to approximate very closely, or quite unite. Nothing now will remain to make perfect the sailing and steering, but to place the centre of the effort of the sails perpendicularly over the two centres before-named. If this be not effected, then whichever way the preponderance of the power of the sails operates, it will, if towards the stern, cause the head to fly up into the wind; and if towards the head, cause it to fly from the wind. The helm, which is the tell-tale, will counteract in part these propensities; likewise the reduction of sail at either stern or head, but that must be at the expense of speed.

If what has been stated be admitted to be correct, the three centres then ought to coincide as nearly as practicable, when the steerage will be easy, and only require the motion of the rudder to overturn the equilibrium to alter the course.

Again, the centre of gravity, though situated correctly as to its height, may yet be extremely injurious to easy motion of pitching and scudding, if the heaviest weights be stowed very fore or aft. Instead of which, they ought to be placed at or near the position of the centre of gravity, the object being the rendering the vibration like a scale-beam, easy and without plunging. To fix the exact plan of stowage is out of the question; but it is best completed at sea, correcting any evils that may be found expedient.

The place of the centre of gravity between the head and stern, is ascertained pretty correctly by the surface of the water coinciding with the load water-line, obtained and laid down from a correct model. But the axis of its height is extremely difficult of detection; and the readiest mode which presents itself would be, the placing of three or more cups or open vessels filled with water, upon separate yet movable shelves, a few inches or more perpendicularly above each other, at the centre of the ship's width and centre of gravity, taken lengthwise. This being done, a lateral rolling motion communicated to the ship artificially, or the taking advantage of a light wind upon smooth water, and observing particularly the surfaces of the water in the cups; then if the water in

any one of them be seen merely to rise up first on one side, afterwards on the other, but in the remaining cups if the motion of the water be more rapid, even to overflowing—that first cup, wherever situated, cannot be far from the axis of lateral motion. Should any doubt on this question arise, just shift the said cup a trifle higher or lower, until the due quietude of its water surface be obtained.

(To be continued.)

Translated for the Journal of the Franklin Institute.

Account of a Diamond, larger than the Regent's, found at Nizam. Extract of a Letter, published by Capt. Fitzgerald, attached to the service of the Nizam.

Thirteen or fourteen years ago, a very large diamond was found in the country of the Nizam. The figure which we give is that of only one part of it: a piece, which had been split off, was finally bought by an Indian broker for 70,000 rupees. The large piece, which is here figured, is now in the possession of the Nizam, and when it was discovered was shown to many Europeans.

The manner of the discovery merits to be reported. This diamond was met, for the first time, in the hands of an Indian child, who was playing with it without any one suspecting its value. Eight *annas* having been offered to the parents of the child, who were poor, the offer aroused their attention, and induced them to inform themselves as to the true value of the stone; and thus it was discovered to be a true diamond, and one of the largest known. The dimensions of the stone, measured exactly on a lead model of it, are as follows:

Length,	2·45 inches.
Exact breadth,	1·35 "
Mean thickness,	0·92 "

The author of this note, having had exact glass models made from those of lead, found their absolute weight 1164·5 grains.

Specific gravity, 3·7 "

The mean specific gravity of the Diamond is 3·52 "

Supposing, therefore, the model accurate, the weight of the diamond is a little less than 1108 grains, or 277 carats for the rough diamond, and so it is generally admitted that rough stones lose one-half their weight in cutting and polishing, there would still remain 138·5 carats; that is an intermediate weight between that of the Regents' (136·75) and that of the diamond of the Grand Duke of Tuscany (139 carats;) if we suppose that the piece split off weighed one-eighth of this weight after cutting, we shall have a weight of 155·5 carets, which would place it between that of the Grand Duke of Tuscany and the large Prussian diamond, (195 carats,) which also came, as is known, from India.

It is not stated whether this stone is also of good water, which can, however, only be known after polishing; but it is known that the Indians, especially those of the Deccan, are very good judges of diamonds; and if it be true, as is reputed, that they paid 7000 rupees for the purchase, it is a favorable augury for the quality of the diamond. In the meantime,

Fig. 1.

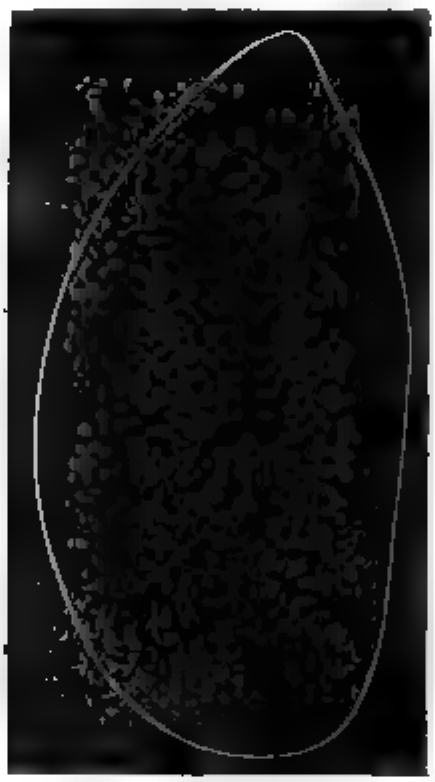


Fig. 2.

if we want an approximate value of the piece alone, which weighs 138·5 carats, as the approximate value of rough diamond is ordinarily obtained in commerce, by squaring their weight in carats and multiplying this number by 50 francs, we shall find for this one the value of 3,836,450 francs ($767,290.)—*L'Institut*, 1852, *p.* 119.

For the Journal of the Franklin Institute.

Dynamical Effect of Falling Bodies.—Results of Experiments made with a view to determine the dynamical effect of bodies falling freely, with the accelerated force due to gravitation.—Read before the Engineers' Institute of New York, Nov. 18, 1852. By Chas. H. Haswell, Esq.

Existing rules regarding the momentum of falling bodies having for a long time failed to satisfy me of their accuracy, I have been led to an investigation of the subject, aided by a series of experiments, which afford very conclusive elements for the construction of the necessary formulæ to apply their results to practice.

The principal instrument used for the purpose of determining the effects was a spiral-spring weigher, which, by the attachment of spring pawls on the sides of it, delicately retained in ratchets, it was retained in its compression; and from an index, sliding over a scale graduated to half pounds, the results were enabled to be accurately registered. The weights were of lead, elongated in their shape; the cords were of hemp,

made up of loose strands, which afforded great flexibility, and the distances were determined from the centres of gravity of the weights.

By this arrangement of pawling the spring, it will readily be recognised that the weights, at their last impacts, were in no wise retarded in their full distance, and as they could not fall beyond it, the full and exact measure of their force was always obtained.

With a view to simplification and facility of comparisons, units of spaces were first decided upon, and the velocities due to them were then determined by the formula $\sqrt{s\,2g}$; s representing the space fallen through, and g, the velocity acquired at the end of the first second, *i e.*, 32·166 feet.

Weight of falling body, in lbs. Avoirdupois.	Space fallen through, in feet.	Velocity acquired at end of fall, in feet per second.	Dynamical effect as indicated by instrument, in lbs.
·5	·5	5·67	12·5
·5	1·	8·02	17·75
·5	2·	11·34	25·
·5	3·	13·89	31·
·5	4·	16·04	36·
·5	5·	17·93	40·
1·	·5	5·67	25·
1·	1.	8·02	35·5
1.	2.	11·34	50·
1·5	·5	5·67	37·
1·5	1·	8·02	53·
2·	·5	5·67	50·
2·	1·	8·02	71·5

With a view to the attainment of all practicable accuracy, the entire experiments were repeated three times, and in each case the weights were made to fall until the limit of impact had been clearly obtained.

An inspection of these results shows, first, *that the dynamical effect or measure of impact, is directly as the velocity acquired;* second, *that one pound falling through a space of one foot, and having a final velocity of* 8·02 *feet per second,* has an impact of 35·5 lbs. From these elements there is readily obtained a formula by which the measure of this force, M, may be correctly arrived at, and which is,

$$M = v \text{ W } 4{\cdot}426.$$

When v = velocity at end of fall in feet per second, and W = weight of falling body in pounds.

Then, to obtain the weight required for a given impact and height of fall, we have by inversion,

$$\frac{M}{v\ 4{\cdot}426} = \text{W}.$$

These experiments, however, have not been made with a view to arrive at the ultimate measure of impact of a falling body; as such a result is held to be impracticable of observation, inasmuch as, theoretically it is *infinite*, and experimentally unattainable, without including an expenditure unauthorized by the benefits to be derived from them; as the law determining the effect of falling bodies is sufficiently well understood to render an illustration of this operation unnecessary. My purpose, then,

has simply been, that of giving a measure by which to estimate the effect of a pile driver or any like instrument, wherein the inelasticity and crushing of the materials composing the instrument and the pile itself, are such as to set aside ultimate attainments of impact.

For the Journal of the Franklin Institute.

The Iron Steamer Richard Stockton.

A new iron steamer, the *Richard Stockton*, has recently made her appearance on the Delaware, having been built by Messrs. Harlan & Hollingsworth, of Wilmington, Del., from the designs of Robert L. Stevens, Esq. Her dimensions are as follows:

Length on deck, . .	270 feet.
Breadth of beam, . . .	30 "
Depth of hold, . .	10 "
Draft of water, . . .	4 " 2 inches.

Her engine is of the kind known as the *top lever* or river beam form.

Diameter of cylinder, . . .	48 "
Length of stroke, . . .	12 "

Paddle wheels of iron exclusively, and of the kind known in England as the *Morgan wheel*, and but recently introduced into this country.

Diameter of wheel, . .	22 feet.
Cast iron paddles, . .	30 inches wide, by 10 feet long.

In this form of wheel, the paddles are attached to the arms of the wheel by journals, on which they vibrate, and by means of eccentric motion they are made to enter and leave the water vertically. Where small wheels are a matter of necessity, or where the steamer has a great variation in her draft of water, the Morgan wheels may be used to advantage; but for our rivers, the common form will be found fully as effective, while the expense of keeping the latter in order is very much in their favor. In addition to this, the Morgan wheel is at least 50 per cent. the heaviest.

The workmanship of both hull and engine is good, and does credit to the builders; while the accommodations for passengers cannot be surpassed, much taste having been exercised in fitting up the cabins and saloons.

In speed, the *Stockton* will not be a *wonder*, judging from her performance on her recent trip to Tacony. With 22 inches of steam, she made but 24 revolutions per minute; while the *Thomas Powell*, on the Baltimore route, having an engine of the same size, can make 24 revolutions of a 28 feet wheel of the common form, and it is well known that the latter is more efficient (equal revolutions and diameters considered) than the Morgan wheel. On inquiry, I found that the *Stockton* was designed to make 30 revolutions per minute, and that the deficiency of 20 per cent. in that respect was principally owing to the boilers, which, although they have sufficient generative power, yet having but a small amount of steam room, they will *foam* or *prime*. This involves the necessity of partially shutting off the engine, and hence a loss of speed.

B.

Translated for the Journal of the Franklin Institute.

On the Density of the Earth. By M. Reich.

In a previous investigation, which has become quite celebrated, M. Reich gave the number 5·45 as expressing the probable mean density of the earth. The immense and memorable researches of Mr. Baily, resulted in the larger number, 5·66. The English astronomer brought to his experiments so much care and so many precautions of all kinds, that M. Reich considered himself beaten. But neither he nor Mr. Baily could explain the much too great difference which existed between the two numbers obtained. After long years of silence and meditation, M. Reich reappears on the arena. Some modifications, and a happy manipulation suggested by Mr. Forbes, have allowed him to repeat his experiments; moreover, a careful study of Mr. Baily's work, has proved to him satisfactorily that the number 5·66 is too large. Without supporting the number 5·45, which is too small, he affirms that the mean density of the earth does not exceed 5·58.—*Poggendorff's Annal. Vol. lxxxv., Arch. des Sciences, June,* 1842, *p.* 137.

Remarks.—The same conclusion as to the error in Mr. Baily's result, was pointed out by M. Saigy, in *Revue Scientifique et Industrielle, November,* 1852. He attributes it to a slight error in the value of the moment of inertia of the lever and torsion bar. He calculates the value of the mean density from Baily's experiments, as between 5·47 and 5·55, and asserts 5·5 as the most probable value. This makes the accordance of Cavendish, Reich, and Baily, very satisfactory. M. Saigy also suggests that still greater confidence would be obtained by enclosing every part of the apparatus in exhausted glass tubes, to avoid the effects of atmospheric pressure.—*See Bibl. Univ: de Genève, Vol. xliii., p.* 180.

Ed.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, November 18, 1852.

Samuel V. Merrick, Esq., President.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Communications were read from the Royal Institute, The Royal Geographical Society, and the Institute of Actuaries, London; The Smithsonian Institution, Washington City, D. C., and S. W. Roberts, Esq., Philadelphia.

Donations were received from The Royal Geographical Society, and the Institute of Actuaries, London; The Smithsonian Institution, and Prof. A. D. Bache, Washington City, D. C.; The Baltimore and Ohio Railroad Company, Baltimore, Md.; and Messrs. Solomon W. Roberts, W. H. Wilson, Dr. L. Turnbull, and George M. Conarroe, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for the month of October was read.

The Board of Managers and Standing Committees reported their minutes.

The Committee on Exhibitions presented their Report of the recent Exhibition of American Manufactures.

On motion, the following awards of the *Gold Medal* were made, in accordance with the recommendations of the Committee on Exhibitions, in their report presented this evening.

To Day & Newell, of New York, for their Parautoptic Bank Lock.

To Henry H. Stevens, of Webster, Mass., for his manufacture of Linen Sheetings, Diapers, Crash, &c.

To W. H. Horstman & Son, of Philadelphia, Penn., for their manufacture of Fancy Taffeta Bonnet Ribbons.

To W. P. Cresson & Co. of Philadelphia, Penn., for their manufacture of Tinned Hollow Ware.

Resignations of Membership in the Institute (49) were read and accepted.

New candidates for Membership in the Institute (120) were proposed, and the candidates (12) proposed at the last meeting were duly elected.

[The scientific discussions at this meeting are unavoidably omitted.]

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. J. Thomson's Apparatus for Boring Artesian Wells, &c.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, an "Improvement on the Machine for Boring Artesian Wells," invented by Mr. John Thomson, of Kensington, Philadelphia, Pennsylvania,—Report:

That said machine consists of a cylindrical iron weight, from six to eight feet in length, and from three to four inches in diameter; to the lower end of which a chisel or cutting tool is attached. An iron rod of about one inch square, and having in a portion of its length a twist given to it of from one-fourth to one-half turn per eighteen inches or two feet, is connected with the upper end of the cylindrical weight, by means of a swivel joint. The twisted portion of the rod passes through two small metal disks, one of which, having a square hole, serves as a guide to the rod. These disks are connected together by four elliptical steel springs, intended by their pressure upon the sides of the boring, to retain the guides in their proper position. Shoulders, movable at pleasure, are so placed upon the twisted portion of the rod as to prevent more than about eighteen inches of the latter passing freely through the guides; in doing which, it must necessarily make a part of a revolution, and the operation of raising the weight being comparatively slow, and the friction on the swivel joint considerable, the weight revolves with it; but when allowed

to fall, this latter drops without turning, in consequence of its inertia and of the friction upon the swivel being in a great degree removed.

It is worked in the Chinese manner, by means of a rope attached to the upper end of the rod, and may be made to strike any required number of times in a revolution, by shifting the position of the movable shoulder. This instrument is an improvement on that used in China, and which was introduced into Europe about the year 1828, for the purpose of overcoming certain difficulties attendant upon the ordinary method of boring by rods.

The most important of which are, 1st, The weight of the rods when the boring has attained any great depth. 2d, The time consumed in cleaning the hole, which must be done once for every foot or eighteen inches of depth; the operation sometimes requiring an entire day. 3d, The vibration produced by the great weight and length of the rods, causing them to break in some instances into several pieces. 4th, The bending of the rods, and consequent change of direction in the boring. From these objections the Chinese method is in a great degree exempt. But it has one peculiar to itself, namely, the irregularity in the turning of the chisel; it being necessary, in order to insure its revolution at all, that one man should be constantly employed in turning the rope, while the others work the machine; and this, as may be readily conceived, cannot be attended with altogether satisfactory results. It was to remedy this defect that Mr. Thomson's machine was devised.

The Committee were much pleased with its operation in model, but feared that in practice its revolution would be impeded by the friction against the rock, or by any slight obstruction which might take place, and thus the benefits anticipated from its use be in a great measure destroyed. To overcome this objection on the part of the Committee, Mr. Thomson caused a working machine to be made, and placed it in a well in Mr. Greble's marble yard, where it drilled a distance of thirty feet five inches through a hard gneiss rock; the greatest depth accomplished in one day being six feet and a half, from nine feet to that of fifteen feet six inches.

To test it still further, the Committee met at Mr. Greble's on Monday, 7th instant, when the machine was put up in such a manner as to permit its being examined with the greatest facility. The endeavor was made to prevent its turning, first by pressing the hands on either side of the weight, and then by means of two boards fastened together at one end, and giving a leverage of some three or four feet; but notwithstanding the friction thus produced was so great as to require the utmost exertion on the part of the men to raise it, yet so long as the body causing the friction remained stationary and allowed the weight to ascend, the latter turned with as much certainty and precision as when working freely.

The Committee are, therefore, of the opinion, that their fears above expressed, were groundless, and that the machine is a great and decided improvement on the Chinese method, and that it is superior to any other method within their knowledge. They are also of opinion, that any tendency which may exist in the Chinese instrument to depart from the ver-

tical, is obviated in that of Mr. Thomson, through the weight being always retained by the guides in the axis of the boring.

By order of the Committee,

WILLIAM HAMILTON, *Actuary.*

Philadelphia, Sept. 10, 1852.

DESCRIPTION.

A is a cylindrical iron bar, nearly filling the bore-hole, and about five feet long; to the bottom of this is attached the chisel for drilling. On the top of this cylinder at D, is a swivel with a square iron bar about four feet long and one inch diameter, passing through an elliptical steel spring, and fixed to the rope B. The elliptical spring, E, is of four strips, 18 or 20 inches long, and embraces the sides of the bore-hole in the rock, the lower disk of which has a round and the upper a square hole for the bar, C, to work in. It will be observed, that there is a twist of about a quarter turn upon the upper end of the bar, C, and a ring or shoulder, movable at pleasure, is fixed upon this bar, and within the spring, as represented at F. The spring, E, acts as a brace by pressing outwardly, and remains in a fixed position while the machine is at work.

Various methods may be adopted for working this apparatus, either by manual power or otherwise, as all that is necessary is to raise and drop the machine about 18 inches, more or less, by means of the rope from the surface of the ground.

The figure in the engraving represents the machine suspended in the hole in the rock, having been raised a little; its operation is as follows:

The power from the top by pulling the rope lifts the whole, except the spring, E, (the bar, C, merely passing through it;) but as C is a square bar, and the top disk of the spring has a square hole neatly fitting it, and as there is a twist upon that portion of the bar, it follows as a matter of course, that the whole apparatus, except the spring, will turn round a

portion of a circle when rising, agreeable to the twist upon said bar. Having thus raised it 18 inches, the shoulder on C, represented within the spring at F, will be nigh the top of the spring, and the next action is the drop, which must be done in the freest manner, when down comes the weight, A, exactly in the same position in which it was suspended, without in the least following the back course of the twisted bar, which in the drop merely resumed its former position. This straight drop of the heavy weight was obtained from the swivel, D; for although that swivel lifts the weight and bears it round with itself in the rising, it will be observed that there is no weight upon it whilst in the act of falling, as the bar, C, comes down by its own gravity as quick as the bar, A. In raising for the second stroke, the heavy cylinder, A, with the chisel, is swung round another portion of a circle by means of the twisted bar passing through the spring, and being suspended freely in the middle of the bore-hole, the drop is perpendicular, and in the position in which it hung. The spring is gradually carried down as the boring proceeds.

According to the nature of the rock, the chisel will make any number of strokes or cuts for each revolution, by shifting the shoulder, F, to another position upon the bar, C, which allows more or less of the twist to pass through the spring.

To clean the hole or boring, the machine is wound up by the rope to the surface, and the cleaner substituted for the chisel. Any size of hole may be drilled with this instrument, and it will work for a few feet in depth or many hundred feet by simply lengthening the rope.

It is a simple machine, and any good machinist may construct them. The common chisels and cleaner are used, but modified to suit. The cleaning of the whole is done rapidly, as there are no rods to detach, as in rod-boring.

BIBLIOGRAPHICAL NOTICE.

Industrial Drawing, comprising the description and use of Drawing Instruments, the construction of Plane Figures, &c. By D. H. MAHAN, &c. &c. New York: John Wiley, 1852. 8vo. pp. 156.

The object of Prof. Mahan in this work, is to explain the method of drawing, as well from models as from diagrams, the use of instruments, &c., in such a manner as to be easily understood by a common workman, and thus to render them intelligent agents in doing things which they now do blindly, and of course badly. Every one who has had occasion to have a machine of any complexity constructed, will appreciate the advantage of such a work, which is intended as a text book for instruction, and is very full as well as very clear and explicit. A chapter on Topographical drawing is affixed. We need scarcely say, what the name of the author will assure most of our readers of, that the work is executed with great ability, and is handsomely presented before the public.

ED.

INDEX.

LIST OF AMERICAN PATENTS, WITH REMARKS, &c.